Greenhouse Gas Emissions Reductions Policies: Attitudinal And Social Network Influences On Employee Acceptability

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For

Janice Elizabeth Dye

(1956-2011)

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Abstract

The UK is required to reduce its greenhouse gas emissions by 80 per cent from 1990 levels, by 2050. Greenhouse gas emissions attributed to the UK higher education sector have increased by 34.5 per cent from 1990 to 2005. Higher education institutions have a unique role in the UK greenhouse gas emissions inventory, beyond management of their own estates and compliance with policy and legislation, higher education institutions have responsibilities as innovators and educators, inspiring students and employees through example and best practice.

This study sought to understand acceptability of greenhouse gas emissions reduction policies among employees of a higher education institution. The value-belief-norm theory was used in a questionnaire to understand individual attitudinal factors thought to influence policy acceptability (*N*=405). Recognising that an employee's attitudinal factors may be influenced by their work colleagues, this study used social network analysis to understand the social context within which individual attitudinal factors sit.

Support was found for higher education institutions to reduce their greenhouse gas emissions. Employees found policies that encouraged desired behaviours, such as assistance with train travel costs and working from home, to be more acceptable than policies that discouraged undesired behaviours, such as doubling the price of a car-parking permit. Support was found for the structure and content of the value-belief-norm theory, but logistic regression suggested that it provided a weak explanation of employee policy acceptability, indicating that other factors may have a greater role.

Analysis of workplace social networks suggested that employees have small social groups ($\bar{x}$=8) and do not select to be close to colleagues that reflect their own perspectives. Practitioners and policymakers should seek to address this void in environmental social norms through recruitment of more environmental champions to deliver strong and persuasive pro-environmental messages.

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Abbreviations and Acronyms

AC	awareness of consequences (construct from NAT)
AR	ascription of responsibility (construct from NAT)
CO_2	carbon dioxide
DBIS	Department of Business, Innovation and Skills
Defra	Department for Environment, Food and Rural Affairs
DfES	Department for Education and Skills
DMU	De Montfort University
EAUC	Environmental Association of Universities and Colleges
E-I	external-internal index
ESB	environmentally significant behaviour
GHG	greenhouse gas
HEFCE	Higher Education Funding Council for England
IPCC	Intergovernmental Panel on Climate Change
NAT	norm-activation theory (Schwartz, 1977)
NEP	new environmental paradigm (Dunlap and Van Liere, 1978; Dunlap *et al*., 2000)
PN	personal norms (construct from NAT)
PPMV	parts per million volume
SDTF	Sustainable Development Taskforce
SNA	social network analysis
TPB	theory of planned behaviour (Ajzen, 1991)
UK	United Kingdom
VBN	value-belief-norm (Stern *et al*., 1999; Stern, 2000)

Chapter 1 Research context

1.1 The problem of greenhouse gas emissions

In the 1820's, French physicist Joseph Fourier proposed that, given the Earth's distance from the sun, components within the Earth's atmosphere must trap solar radiation for the temperature on Earth to be as warm as he recorded it. John Tyndall (1863) was the first to measure and compare the gasses in the atmosphere and assess their contribution to trapping heat. Approximately 30 years later, Svante Arrhenius (1896) proposed that varying levels of carbon dioxide (CO_2) in the atmosphere could explain previous ice ages, suggesting that the burning of fossil fuels releases CO_2 into the atmosphere, thus warming the planet. The same process of heat being trapped by a planet's atmosphere by gasses is responsible for the temperature on Venus being higher than the temperature on Mercury, even though it is twice the distance from the Sun.

From 1750, the start of the industrial revolution, the concentration of CO_2 in the Earth's atmosphere has increased from 280 ±10 parts per million volume (PPMV) (IPCC, 2007) to 393.52 PPMV as of September 2013 (NOAA, 2013). Analysis of ice cores from Vostok, Antarctica and the European Project for Ice Coring in Antarctica (EPICA) Dome C, Antarctica, show that levels of CO_2 in the Earth's atmosphere over 800,000 years before present have ranged between 180 PPMV and 280 PPMV, taking approximately 100,000 years to complete a full cycle from 280 to 180 and back to 280 PPMV (Lüthi *et al.*, 2008). Therefore, the rate and level of the rise in CO_2 concentrations since 1750 is unprecedented.

The Intergovernmental Panel on Climate Change (IPCC), an international intergovernmental group formed in 1988 to assess current scientific, technical and socio-economic information about the risk of climate change, in their Fourth Assessment synthesis report suggest that "warming of the climate system is unequivocal" (IPCC, 2007:5), and "most of the observed increase in global average temperatures since the mid-20th century is very likely due to the

observed increase in anthropogenic greenhouse gas concentrations" (IPCC, 2007:10). Working group I of the IPCC has recently reported draft findings for the Fifth Assessment. The degree of certainty that human activities are driving changes in climate has increased from ‘very likely’ (90 per cent certainty) to ‘extremely likely’ (95 per cent certainty).

The IPCC prognosis is for negative consequences for the planet’s inhabitants from climate change. Consequences include changes in precipitation, sea level rise, temperature rise, and increase in the frequency of extreme weather events, leading to issues for food security, human health, ecosystems, settlements and society and water resources (IPCC, 2007).

International action to address global greenhouse gas emissions since the formation of the IPCC has been agreed. A significant step was the ratification of the Kyoto Protocol in 2005, with 37 countries agreeing to a collective reduction in emissions of greenhouse gasses, 5.2 per cent below 1990 levels by the reporting period 2008-2012.

The UK Government ratified the Kyoto Protocol on 31st May 2002, agreeing to a 12.5 per cent reduction in greenhouse gas emissions on 1990 levels by 2012. In addition to ratification of the Kyoto Protocol, the UK Government published the Climate Change Act (2008). The Act requires UK greenhouse gas emissions to be 34 per cent below 1990 levels by 2020, and 80 per cent below 1990 levels by 2050. Using the Kyoto accounting method, provisional greenhouse gas emissions estimates for the UK for 2012 were 26 per cent lower than in 1990 (DECC, 2013).

In 2011, the UK public sector accounted for 2.9 per cent of UK greenhouse gas emissions. In this thesis, the focus is on the UK higher education sector, which is accounted for in the 2.9 per cent attributed to the UK public sector. In 2005, the UK higher education sector accounted for 0.51 per cent of the UK national total of greenhouse gas emissions (HEFCE, 2010).

1.2 The UK higher education sector

The higher education sector has a unique place in the UK greenhouse gas emissions picture. UK higher education institutions have a significant role and responsibility as educators of the shapers of the future. Instilling values of environmental protection in its graduates is imperative, and the higher education sector has a significant role to play in instilling these values through its teaching. Higher education institutions also shape the world through their research activities, through the advancement and dissemination of scientific knowledge that shapes policy and practices, ideas and products. Finally, it is the management of its own estate through which a university can set an example of best practice and inspire those associated with the institution to follow suit in their own private behaviours, attitudinal perspectives and work roles.

The unique place of the UK higher education sector is recognised by the Higher Education Funding Council for England (HEFCE). HEFCE fund and administer the UK higher education sector, as an agency acting in conjunction with the Department for Business, Innovation and Skills (DBIS). The HEFCE Sustainable Development Strategy (2009:3) includes the target “Within the next 10 years, the higher education sector in this country will be recognised as a major contributor to society's efforts to achieve sustainability - through the skills and knowledge that its graduates learn and put into practice, its research and exchange of knowledge through business, community and public policy engagement, and through its own strategies and operations”.

In the consultation for the HEFCE Sustainable Development Strategy, 70 per cent of participants strongly supported the proposal for a carbon reduction target for the higher education sector (HEFCE, 2009). HEFCE have adopted greenhouse gas emissions reductions targets that are aligned with the national targets set in the Climate Change Act (2008). These are for the higher education sector to reduce greenhouse gas emissions below 2005 levels by 43 per cent by 2020 and by 83 per cent by 2050 (HEFCE, 2010). In 2009, the UK

Government stipulated that future capital funding from HEFCE to each university should be linked to the university's progress in tackling its own greenhouse gas emissions (Denham, 2009). Although there has been a change in government, successive grant letters to HEFCE have restated that universities should continue to work towards carbon reduction targets and environmental sustainability.

Delivering against emissions reductions targets will be challenging, however. From 1990 to 2005, greenhouse gas emissions attributed to the UK higher education sector increased by 34.5 per cent (HEFCE, 2010). Although this increase in greenhouse gas emissions is related to the increase in the size of the sector – student numbers almost doubled, from 1.4 million in 1994/5 to nearly 2.5 million in 2011/12, and staff numbers more than trebled, from 114,721 to 378,250 over the same time period - it is concerning given that at the national level, the greenhouse gas emissions trend shows significant progress and targets met.

For each higher education institution, greenhouse gas emissions are classified according to the World Resources Institute (WRI) / World Business Council Sustainable Development (WBCSD) Greenhouse Gas Protocol method (2004). This method (depicted in Figure 1) classifies greenhouse gas emissions resulting from fuel used directly in university owned buildings or vehicles as Scope one; indirect greenhouse gas emissions resulting from electricity consumption as Scope two; and staff and student commuting, staff business travel, international student travel, waste and water use as Scope 3.

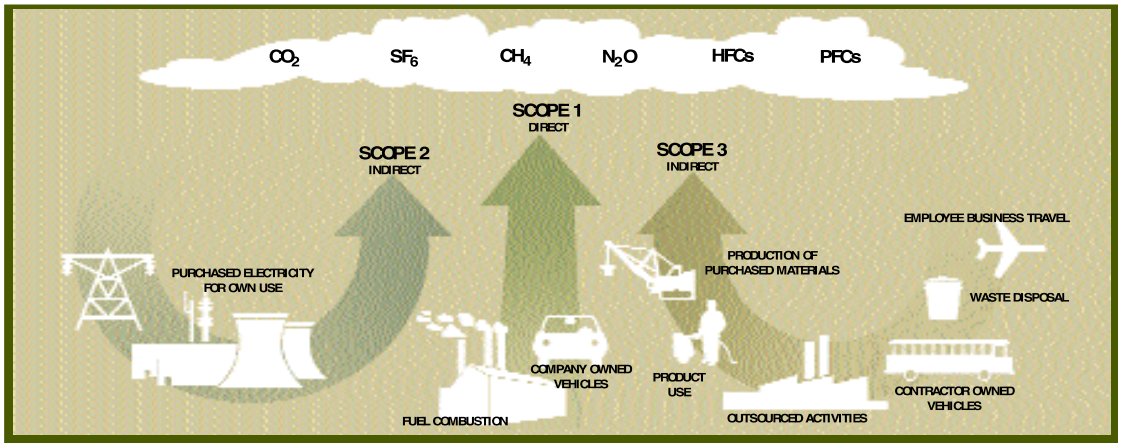

Figure 1: WRI/WBCSD overview of greenhouse gas emission boundaries (2004)

1.3 Regulatory policies

Organisations, such as universities, control many of their operations through policies. Policies shape and control the way in which employee's operate and complete tasks. Regulatory policies can serve to compel certain types of behaviour, incentivising desired behaviours, and restricting undesired behaviours. Regulatory policies are typically managed and delivered by senior executives and central administrators within organisations. This is most obviously true of the human resources function within organisations.

University's can bring about reductions in their greenhouse gas emissions through regulatory policies. ISO14001 is an example of an environmental policy that is adopted by large organisations, covering standards related to environmental management.

1.4 Explaining policy acceptability

The success of regulatory policy within an organisation is partially dependent upon the acceptability of the policy by the organisation's employees. According to Stern's (2000) typology, policy acceptability can be considered to be a type of 'non-activist behaviour in the public sphere', one of four types of environmentally significant behaviour (ESB). Stern (2000:409) suggests that policy acceptability can only affect the environment indirectly, but suggests that

the effects “may be large, because policies can change the behaviours of many people”. Delivering acceptable policies offers organisations such as universities effective and efficient opportunities to reduce their greenhouse gas emissions.

To explain environmentally significant behaviours such as policy acceptability, Stern *et al.* (1999) and Stern (2000) developed the value-belief-norm (VBN) theory. The VBN theory is comprised of three components, linking values theory (Schwartz, 1992, 1994) to worldviews (Dunlap and Van Liere, 1978; Dunlap *et al.*, 2000) and norm-activation theory (Schwartz, 1977), in a causal chain of attitudinal factors. The VBN theory was found to provide an explanation for two of the four types of environmentally significant behaviour - *private sphere behaviour* and *non-activist behaviour in the public sphere* (Stern *et al*., 1999; Stern, 2000).

The VBN theory was also found to differentiate between policy acceptability and environmental citizenship, both considered to be *types* of non-activist behaviour in the public sphere. Stern *et al.* (1999) found the VBN theory to provide the best explanation of policy support and acceptance, even when the alternative theories with which it was compared, were combined. Stern *et al.* (1999:91) suggested, “the VBN theory provides the best available social-psychological account of non-activist support”.

Whilst the VBN theory provides the best available account of non-activist support, it is limited in its scope as it includes only one of four types of ‘causal variable’ proposed to influence environmentally significant behaviour (Stern, 2000). Stern (2000) suggests that ‘attitudinal factors’, ‘contextual factors’, ‘personal capabilities’, and ‘habits’ are four distinct categories of causal variable that may assist in explanation of environmentally significant behaviour. Stern (2000) suggests that studies of environmentally significant behaviour should select a tailor-made combination of causal variables for each study.

In a setting such as the workplace, attitudinal factors of the kind covered by the VBN theory may be shaped by social context and social influences. The importance of social context has been recognised by Uzzell and Rahzel

(2009:341) who criticise current research trends focussing only on attitudinal factors, “while values and attitudes are clearly important in influencing behaviour, values and attitudes are not formed in a social and cultural vacuum. They are embedded, nurtured and emerge from a social context”. To understand the social context from which individual attitudinal perspectives emerge, a sociological approach is required to complement the VBN theory in explaining acceptability of policies.

1.5 Social Network Analysis

Social network analysis provides a sociological approach by which social context and interpersonal influence can be examined. A social network approach is distinct from other sociological approaches as it focuses on the relationships between interacting individuals, and on the patterns and implications of these relationships. Individuals are viewed as interdependent, rather than independent (Wasserman and Faust, 1994).

The recognition by Uzzell and Rahzel (2009) that attitudes and behaviours are not formed in a social and cultural vacuum is represented exactly by the interdependent rather than individual nature of the perspective in social network analysis. This interdependent and structural lens is therefore an ideal perspective through which to view individual attitudinal perspectives and behaviours, and for them to be viewed in the context of the attitudinal perspectives and behaviours of those that they are connected to.

1.6 Research setting

The setting for this research is De Montfort University (DMU). Based in Leicester, UK, DMU is one of 35 former polytechnic colleges that were granted university status in 1992 as part of the Further and Higher Education Act (1992). DMU has approximately 22,000 students enrolled on its courses, and approximately 2,700 employees. DMU operates 29 buildings, housing four faculties and 12 non-academic departments (DMU, 2013).

Pre-empting HEFCE calls to address greenhouse gas emissions, DMU have a 'Sustainable Development Taskforce' (SDTF), formed in 2007. The SDTF is comprised of a cross-faculty group of experts in the field of environmental issues, and practitioners with responsibilities for delivering policy at the University. The SDTF provide a central focus for moving DMU towards an environmentally sustainable future. The aim of the taskforce is "to position DMU as one of the country's leading universities in sustainable development – in terms of the operation of the University, the content of its courses, its research excellence and its leadership both in the local community and internationally" (DMU, 2009:4). The SDTF provided the funding for this research.

1.7 Research overview

The research presented here aims to explain employee acceptability of policy proposals that are designed to bring about reductions in the organisation's greenhouse gas emissions. To do this, a theory of behaviour is applied to understand the individual attitudinal factors influencing policy acceptability. Individual attitudinal factors are examined within the context of an employee's workplace social network connections.

The above approach has immediate relevance for practitioners employed by the sponsors of this research, for practitioners at other higher education institutions and for large organisations outside of the higher education sector. The research is relevant for future policy considerations at higher education institutions and the national bodies that represent them. In addition, the testing of the full VBN theory will add to the theoretical understanding of the relationships between the components in the theory and their ability to predict a specific type of behaviour within a workplace setting. The use of social network analysis to provide an alternative but complementary perspective on individual attitudinal influences on behaviour in the workplace is novel in the field of environmental psychology. The identification of contagion of environmental attitudinal perspectives and behaviours through social networks would lead to the development of theory in the area.

1.8 Research aim and objectives

1.8.1 Aim

To understand employee attitudinal and social network influences on acceptability of greenhouse gas emissions reductions policies in the higher education sector

1.8.2 Objectives

To meet the aim, there are five objectives:

Objective 1. To understand attitudinal factors influencing acceptability of greenhouse gas emissions reduction policies, using the value-belief-norm theory

Objective 2. To explore employee social networks within a higher education institution

Objective 3. To explore the relationship between attitudinal factors and social networks

Objective 4. To explore the relationship between acceptability of policies and social networks

Objective 5. To test the value-belief-norm theory

1.9 Thesis structure

This thesis has six further chapters. Each is described briefly here:

Chapter 2: Factors affecting acceptability of policy

Presents a review of previous research on causal factors affecting acceptability of environmental policies, leading to the development of two objectives.

Chapter 3: Understanding social context

Presents a review of previous research using social network analysis to understand attitudes and behaviours, leading to the development of three objectives. Hypotheses for all five objectives are described.

Chapter 4: Methodology

Details the design of the questionnaire, recruitment of participants, and the data collection exercises.

Chapter 5: Exploring social networks and understanding attitudinal influences on acceptability

Explores the data collected with the questionnaire and the social networks tasks, and provides an analysis of the value-belief-norm theory data.

Chapter 6: Combining social context and attitudinal influences on policy acceptability

Provides an analysis of the integration of social network and value-belief-norm data.

Chapter 7: Discussion

Discusses the findings presented in chapters 5 and 6 in relation to the hypotheses and literature, and suggests implications resulting from the study.

Chapter 2 Factors affecting acceptability of policy

2.1 Introduction

In this chapter, a review of factors affecting acceptability of environmental policy is undertaken. The chapter begins by defining the terms attitudes, beliefs, acceptability and acceptance (section 2.1.1) and is followed by a description of how relevant literature was identified (section 2.1.2). The chapter is then structured based upon an adaptation of Stern's (2000) identification of four causal variables that are proposed to affect environmentally significant behaviour (ESB). Section 2.2 covers 'attitudinal factors' and section 2.3 covers both 'personal capabilities' and 'contextual factors'. The fourth causal variable proposed to affect ESB by Stern (2000) is 'habits'. No articles were found that had sought to identify habits in order to explain acceptability of policy, and so this causal variable was not covered here.

Section 2.2.1 details studies that have used most or all of the constructs from the VBN theory, to understand policy acceptability. Section 2.2.2 reviews articles that have used some of the constructs from the VBN theory along with other attitudinal factors that are not included in the VBN theory, to understand policy acceptability. Section 2.2.3 describes articles that have not used constructs from the VBN theory, and have identified other attitudinal factors in order to understand policy acceptability.

An overlap between two of Stern's (2000) causal variables, personal capabilities and contextual factors, means that these are dealt with together in section 2.3. The personal capabilities of an individual are somewhat dependent on their context, and the studies described here reflect this overlap.

In section 2.4 there is a step away from Stern's (2000) causal variables structure. Reviewed are three studies that have identified that 'characteristics of policy', such as policy coercion, affect policy acceptability. In section 2.5, all of the studies that seek to understand policy acceptability and are described in

sections 2.2 to 2.4, are brought together in a synthesised discussion, drawing conclusions about the most suitable path to take in this thesis.

2.1.1 Definitions

The term ‘attitudinal factors’ covers a variety of psychological dispositions that are used in models and theories to understand behaviour (Stern, 2000). These psychological dispositions appear in such models and theories as attitudes and beliefs and are collectively labelled as ‘constructs’. The constructs that comprise the value-belief-norm theory (VBN) (Stern *et al.*, 1999; Stern, 2000) are frequently used to understand policy acceptability.

Policy acceptability can be treated itself as an attitudinal factor, as it pertains to a “prospective judgement of measures to be introduced in the future” (Schade and Schlag, 2003:47). However, policy acceptability is treated in this thesis as a type of (environmentally significant) behaviour, following the designation made by Stern (2000) in his development of typologies of ESB. Stern (2000) suggests that policy acceptability is a type of ‘non-activist behaviour in the public sphere’, which, although it does not directly bring about reductions in greenhouse gas emissions, can cause effects that “may be large, because policies can change the behaviours of many people” (Stern, 2000:409). Policy ‘acceptance’, which can also be an attitude and behaviour, refers to judgements of policies post-implementation, and is not studied in this thesis. It is not within the remit of the study to implement a policy and to understand its acceptance once in place.

2.1.2 Method for identifying relevant literature

A combination of methods was used to identify relevant literature. The Science Direct and Web of Knowledge databases and search engines were initially used to identify key papers. Search terms such as “policy acceptability/acceptance” and “environmental/climate change policy” were used. Key articles were identified, and used in forwards and backwards citation searches, using Scopus. For example, the Steg *et al.* (2005) study was identified using the Science Direct search engine, and recognised as a key paper. A backwards

citation search identified two further key papers - the Stern *et al.* (1999) and Stern (2000) studies. According to Scopus (as of September 2013), 90 articles have cited the Steg *et al.* (2005) study, over 300 have cited Stern *et al.* (1999) and over 700 have cited Stern (2000). A search within these citers identified further key articles. This process continued until it was felt that it was unlikely that additional relevant articles would be found. A total of 28 articles studying environmental/climate change policy acceptance/acceptability were identified, and are included for review in this chapter. These 28 studies collected empirical data, and will be used to inform the approach taken in this study.

2.2 Attitudinal factors

Studies in this section use attitudinal factors to explain acceptability of policy. The section is separated into three parts. Firstly, studies that used the value-belief-norm (VBN) theory (or an adapted version of the VBN theory) to explain policy acceptability are described (section 2.2.1). The VBN theory is proposed as the best predictor of policy support and acceptance (Stern *et al.,* 1999; Stern, 2000) and is frequently used in the studies using attitudinal factors to explain acceptability of policy. Because the VBN theory is so frequently used and proposed as the most successful theory with which to understand policy acceptability (Stern *et al.*, 1999), the studies described here are done so in detail in section 2.2.1. Although these studies use most or all the VBN components, they also use additional attitudinal factors that are not covered by the VBN theory. These additional factors are also covered in section 2.2.1.

This is followed by a review of studies that use some of the VBN components, but not the whole theory, alongside other attitudinal factors (section 2.2.2) that are not included in the VBN theory to explain acceptability of policy. The final part of section 2.2 covers attitudinal factors that are not components of the VBN theory, but that are used to explain policy acceptability (section 2.2.3).

2.2.1 Studies using the value-belief-norm theory

To date, only one study has used the full and unaltered VBN theory to understand acceptability of policy (e.g. Steg *et al.*, 2005). In the study where the VBN theory was originally proposed by Stern *et al.* (1999), ascription of responsibility (AR) was not measured, and in five studies that have since used the VBN theory to understand acceptability of policy, all have omitted at least one construct (Dietz *et al*., 2007; De Groot *et al*., 2008; Poortinga *et al*., 2012; Harring and Jagers, 2013; Jakovcevic and Steg, 2013). All seven studies are described here.

Researchers omitting constructs from the VBN theory may have chosen to do so due to the nature of the way that the VBN was constructed. The VBN theory is comprised of three components, covering seven latent psychological constructs. The VBN theory links three constructs tapping 'value orientations' (Schwartz, 1992, 1994) to 'worldviews' (Dunlap and Van Liere, 1978; Dunlap *et al.*, 2000) and the three constructs that form the 'norm-activation theory' (Schwartz, 1977), in a causal chain (see Figure 2). Each of the three components has a proven and extensive track record independently of each other (Stern *et al*., 1999). In addition to omitting constructs that are proposed to make up the VBN theory, some studies have included additional latent psychological constructs, not originally proposed as part of the VBN theory, for example 'trust' in Dietz *et al.* (2007).

The first three constructs in the VBN theory (from left to right) are from the values scale developed by Schwartz (1992, 1994), and measure altruistic, biospheric and egoistic value orientations. The next construct in the theory is the new environmental paradigm (NEP) and was developed by Dunlap and Van Liere (1978) and Dunlap *et al.* (2000). The final three constructs are from the norm-activation theory (NAT), also developed by Schwartz (1977), and measure awareness of consequences (AC), ascription of responsibility (AR) and personal norms (PN). A schematic of the constructs in the VBN theory is shown in Figure 2.

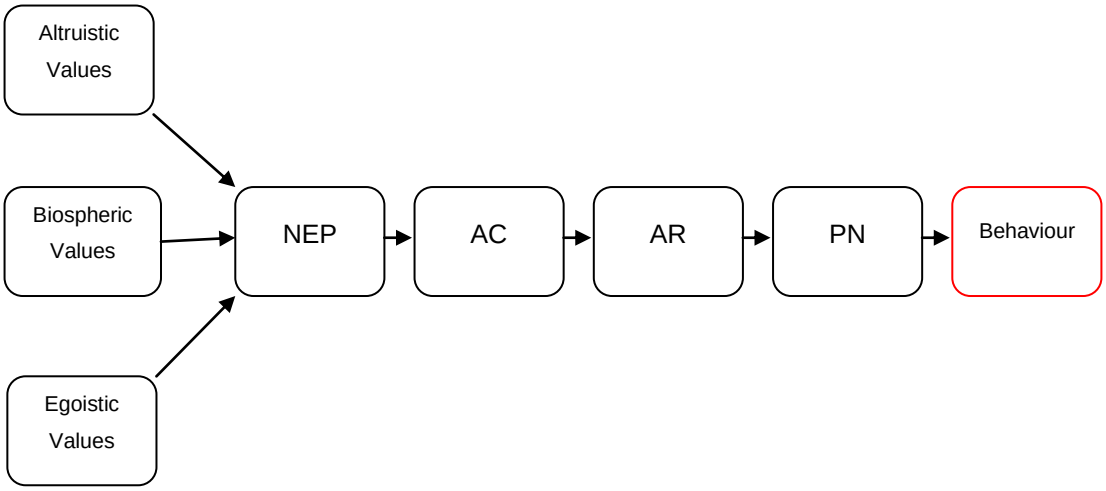

Figure 2: A schematic of the value-belief-norm (VBN) theory (*cf*. Stern, 2000)

The review of studies using the VBN theory starts with the articles in which the VBN theory was originally proposed (Stern *et al.,* 1999) and further developed (Stern, 2000) (*N*=420, U.S, adults). In Stern *et al.* (1999) three behaviours were studied – four items measuring private sphere behaviours (Cronbach's α .72), eight items measuring environmental citizenship (α .77), and three items measuring willingness to sacrifice (α .78). Stern *et al.* (1999) posit that 'willingness to sacrifice' is measured by acceptability of policy.

In Stern *et al.* (1999), the three value orientations shown in Figure 2 (altruistic, biospheric and egoistic values), were not yet developed (Stern, 2000) and so a values scale that more closely matched the Schwartz (1992, 1994) studies was used, with 26 items in four orientations. The four value orientations were self-transcendence (α .86), traditional values (α .80), self-enhancement (α .69) and openness to change (α .62).

Stern *et al.* (1999) included five items from the 15 that comprised the NEP scale (α .73), and 18 items from the NAT, nine each for awareness of consequences (α .91) and personal norms (α .88). As noted, Stern *et al.* (1999) did not measure AR. For the personal norms construct, the nine items were divided into three categories – three for personal moral obligations, three for government obligations and three for business obligations.

Stern *et al.* (1999) found that their VBN theory explained close to 35 per cent (R^2 .346) of the variance in policy acceptability. This was more than the variance explained by the VBN theory for private-sphere behaviour (R^2 .194) and also for environmental citizenship (R^2 .302). Alongside measuring the VBN theory, Stern *et al.* (1999) measured three alternative theories of environmentally significant behaviour – 'cultural theory', 'post-materialism' and 'sacredness of nature', for comparison. Stern *et al.* (1999) found that the VBN theory explained more variance in each of the three behaviours than the three alternative theories. When the three alternative theories were combined, explained variance was reported as being lower than when using the VBN theory alone. Combining the three theories explained ~20 per cent of the variance in policy support (R^2 .199); ~10 per cent of the variance in private-sphere behaviours (R^2 .094); and ~ 19 per cent of the variance in environmental citizenship (R^2 .187).

Stern *et al.* (1999:91) concluded that "a value-belief-norm theory that postulates causal links among variables from three of the six theories in the published literature (values, NEP, NAT) offers the best available theoretical account of all three types of non-activist environmentalism" and that "personal pro-environmental norms (PN) – the belief that the individual and other social actors have an obligation to alleviate environmental problems – are the only social-psychological element common to all three types of non-activist environmentalism".

In Steg *et al.* (2005), the full VBN theory, as originally proposed by Stern *et al.* (1999) and Stern (2000) (i.e. including the ascription of responsibility construct - AR), was used to understand support and acceptance of energy policies (N=112, Dutch population). Steg *et al.* (2005) measure the three value orientations from Stern (2000), the full 15-item NEP, and all three constructs from the NAT.

As noted, the original Stern *et al.* (1999) study measured values representing the four facets identified by Schwartz (1992, 1994). Studies have found that

these four facets can usefully be transposed into three alternatives, measuring altruistic, biospheric and egoistic value orientations (e.g. Stern, 2000; De Groot and Steg, 2008). Steg *et al.* (2005) measured these three value orientations, using four items to measure altruistic values (α .72), four items to measure biospheric values (α .83) and four items to measure egoistic values (α .65).

The full 15-item, updated (Dunlap and Van Liere, 1978; Dunlap *et al.*, 2000) version of the NEP was used (α .73). Twenty-one items were used to measure constructs from the NAT - six for AC (α .75), six for AR (α .80) and nine for PN (α .84). The behaviour in Steg *et al.* (2005) was acceptability of pricing of energy policies to reduce household energy consumption, measured using 16-items (α .90).

Steg *et al.* (2005) found the VBN theory to be successful at explaining acceptability of energy policies. Bivariate regression analyses suggested 29 per cent of the variance in policy acceptability could be explained by the PN construct (effect size f^2 .41), increasing to 32 per cent when multivariate regression analysis including all other variables in the theory was reported (f^2 .47). When all variables were included in the multivariate regression, only the PN construct was found to have a significant relationship with policy acceptability (β .37, t = 3.17, p .002).

Steg *et al.* (2005) used bivariate and multiple regression analyses to test the causal relationships between the constructs in the VBN theory. AR was found to be a successful predictor of PN, explaining 32 per cent of the variance (f^2 .47), increasing to 49 per cent when the remainder of the variables were included (f^2 .96). Ascription of responsibility (β .30, t = 3.52, p .001) and biospheric values (β .35, t = 3.82, p .000) were the only constructs to have a statistically significant relationship with PN. AC was found to be a successful predictor of AR, predicting 21 per cent of the variance (f^2 .27), increasing to 29 per cent (f^2 .41) when the remainder of the variables were included. Both AC (β .36, t = 3.52, p .001) and biospheric values (β .25, t = 2.39, p .019) were found to have a statistically significant relationship with AR.

The New Environmental Paradigm (NEP) was found to be a successful predictor of AC, explaining 28 per cent of the variance (f^2 .39), increasing to 29 per cent when the remainder of the variables were included (f^2 .41). The NEP was found to be the only statistically significant predictor of AC (β .50, t = 5.23, p .000). The three value orientations - altruistic, biospheric and egoistic - were found to be successful predictors of the NEP construct, explaining 25 per cent of the variance (f^2 .33). The three value orientations were found to significantly predict variance in NEP scores (altruistic - β -.20, t = -2.02, p .046; biospheric - β .47, t = 4.89, p .000; egoistic - β -.32, t = 3.63, p .000) and were the only predictors included in the regression model.

Steg *et al.* (2005) used mediation tests to further understand the causal relationships between the variables in the VBN theory, using the four Baron and Kenny (1986) mediation tests and criteria. For each 'step' in the VBN theory, Steg *et al*. (2005) found that each variable sufficiently mediated the relationship between the variable immediately preceding it and the variable that it preceded. For each of the proposed relationships, all four of the Baron and Kenny (1986) tests for mediation were met in Steg *et al.* (2005).

In a further study, Dietz *et al.* (2007) used the VBN theory to understand acceptability of climate change policies amongst the U.S public (N=316). Similarly to Stern *et al.* (1999), Dietz *et al.* (2007) did not measure ascription of responsibility (AR), but did measure both material and post-material values, future orientation and three types of trust (in government, industry and environmentalists).

In Dietz *et al*. (2007), 21 items were used to measure values; three for egoism (α .66), six for altruism (α .85), three for traditionalism (α .51), three for openness to change (α .73), three for materialism (α .67) and three for post-materialism (α .70). Five items from the NEP were used (α .78) and eight items were used to measure trust (three for trust in government α .78, three for trust in industry α .80, and two for trust in environmentalists α .83). Six items were used

to understand future orientation (α .74), six items for AC (α .92) and five items for PN (α .74).

The behaviour measured by Dietz *et al.* (2007) was climate change policy acceptability, using eight items (α .89). The adapted VBN theory, using all of the constructs listed above, explained 66 per cent of the variance in acceptability of the eight climate change policies. The PN construct was removed from the model as it was highly correlated with the NEP construct (*r* = .78) and also with the AC construct (*r* = .59). Greater trust in environmental groups (β .38, B .22, *p*<.001), less trust in industry (β -.30, B -.25, *p*<.001), and AC (β .25, B .18, *p*<.01) were found to be significant predictors of climate change policy acceptability. Dietz *et al.* (2007) also tested the direct, indirect and total effects of each construct on policy acceptability. Of notable interest is that those that are more politically liberal (measured by traditionalism)(direct β .08, indirect β .37, total β .45), more altruistic (direct β -.13, indirect β .38, total β .25) and that hold a stronger future orientation (direct β .03, indirect β .23, total β .26) are more likely to accept climate change policy.

Poortinga *et al.* (2012) studied acceptability of demand side and supply side measures to reduce domestic CO_2 emissions in the UK (*N*=1,822, public, aged 15+). A number of alternative constructs were used in place of omitted VBN constructs. For example, a scale of environmental identity was used instead of the NEP and specific concerns about climate change and energy security were used instead of AC. AR was again omitted from the study, as it was in Stern *et al.* (1999) and Dietz *et al.* (2007).

Four value orientations were measured by Poortinga *et al*. (2012), representing the four dimensions identified by Schwartz (1992, 1994) and originally used by Stern *et al.* (1999). Although each of the four was measured and found to have acceptable reliability scores (self-enhancement - α .62; self-transcendence - α .68; openness to change - α .67; and traditionalism - α .75) both self-enhancement and openness to change were removed before regression analyses. Poortinga *et al.* (2012) used three items to measure environmental

identity (α .80), three items to measure concern about climate change (α .82), six items to measure concern about energy security (α .79) and two items were used to measure PN (α .75). Policy acceptability was measured by six items – three for measuring acceptability of demand side measures (α .69) and three for measuring acceptability of supply side measures (α .72).

In Poortinga *et al*. (2012), the adapted version of the VBN theory was successful at explaining acceptability of demand side measures to reduce CO_2 emissions (R^2= .65), and successful, although to a much lesser degree, at explaining acceptability of supply side measures (R^2= .17). Zero-order correlations were used to describe the relationships between constructs and to explain behaviour. For supply side measures, correlations are always weaker than correlations for the demand side measures, as might be expected given the R^2 values.

Personal norms, for example, had a strong relationship with demand side measures (r = .77, p <.001), and a strong but much weaker relationship with supply side measures (r = .37, p <.001). This is also similarly true of the energy security concerns construct (demand: r = .13, p <.001; supply: r = .08, p <.01), the climate change concerns construct (demand: r = .67, p <.001; supply: r = .31, p <.001), the environmental identity construct (demand: r = .64, p <.001; supply: r = .28, p <.01), and both self-transcendent values (demand: r = .34, p <.001; supply: r = .16, p <.01) and traditional values (demand: r = .12, p <.01; supply: r = .02, *n.s.*).

In two connected studies (De Groot *et al.,* 2008; Jakovcevic and Steg, 2013) acceptability of a transport policy and intention to reduce car use were studied. In De Groot *et al.* (2008) participants were from five European countries (*N*=489; Austria, Czech Republic, Italy, Netherlands, Sweden; snowball sample) whereas in Jakovcevic and Steg (2013), participants were from Argentina (*N*=160; snowball sample). In both studies AR was measured, however, the NEP was not, with both studies preferring to frame their explanation of policy acceptability as values with NAT.

No additional constructs were used in De Groot *et al.* (2008). In Jakovcevic and Steg (2013) three items for 'hedonic' values (α .81) were measured. In both De Groot *et al.* (2008) and Jakovcevic and Steg (2013), four altruistic value items were measured (α .73 & .66, respectively), four biospheric value items (α .86 & .88, respectively) and five egoistic value items (α .74 & .77, respectively). In both studies, 19 items were used to measure AC, AR and PN. In both De Groot *et al.* (2008) and Jakovcevic and Steg (2013), five items were used for AC (α .81 and α .66, respectively), six for AR (α .72 and α .70, respectively) and eight items for PN (α .83 and α .88, respectively). In De Groot *et al.* (2008), one of the items for measuring AR was removed due to poor factor loading scores.

In both studies there were two behaviours. Firstly, acceptability of a policy to double every cost that is associated with driving a car, and secondly, the intention to reduce car use, if the policy was introduced. For each behaviour, responses were required against five statements. For the two behaviours, in both De Groot *et al.* (2008) and Jakovcevic and Steg (2013), scale reliability scores were high (acceptability α .90, intention to reduce care use α .81) and (acceptability α .85, intention to reduce car use α .76).

Similarly to Steg *et al.* (2005), De Groot *et al.* (2008) and Jakovcevic and Steg (2013) used bivariate and multiple regression models to test the ability of the VBN theory to explain behaviour. In the bivariate regression analysis, De Groot *et al*. (2008) and Jakovcevic and Steg (2013) found that the PN construct successfully predicted acceptability of transport policies (R^2= .27, β .52, p < .000; R^2= .12, β .39, p <.01, respectively) and intention to reduce car use (R^2= .14, β .37, p <.000; R^2= .14, β .34, p <.01, respectively). In the multivariate regression analysis, results were similar in both studies. Explanation of acceptability of transport policies increased by a small amount in both studies; from 27 to 32 per cent in De Groot *et al.* (2008) and from 12 to 14 per cent in Jakovcevic and Steg (2013). Similarly, intention to reduce car use increased from 14 to 16 per cent in De Groot *et al.* (2008) and from 14 to 22 per cent in

Jakovcevic and Steg (2013). Both studies indicate that the PN construct is the single best predictor of acceptability of policy and of intention to reduce car use.

Similarly to Steg *et al.* (2005), the multiple regression models identified additional constructs in the VBN theory that are statistically significantly related to policy acceptance and intention to reduce car use. In De Groot *et al.* (2008) PN (β .41, *p*.000), AC (β .22, *p*.000), egoistic values (β -.14, *p*.000) and altruistic values (β -.10, *p*.025) were found to be related to policy acceptability, and PN (β -.23, *p*.001) AC (β -.13, *p*.041) and biospheric values (β .19, *p*.002) were found to be related to intention to reduce car use. In Jakovcevic and Steg (2013) only PN (β .39, *p*<.01) was related to acceptability and only PN (β .25, *p*.03) and altruistic values (β .18, *p*.03) were related to intention.

Both De Groot *et al.* (2008) and Jakovcevic and Steg (2013) tested the causal path relationships between the variables in their adapted VBN theory's. Both studies used multiple regression and mediation analyses, with both finding the variable relationships and causal chain nature of the VBN theory as proposed by Stern *et al*. (1999).

In Harring and Jagers (2013), the VBN theory constructs were used to understand acceptability of an increased CO_2 tax on gasoline (single item). In the study of Swedish residents (*N*=792), self-enhancement (five items, α .70) and self-transcendence (four items, α .77) value orientations, the NEP (10 items, α .66), AC (five items, α .74), AR (five items, α .69) and PN (four items, α .72) constructs from the VBN theory were measured alongside three types of trust – interpersonal (single item), political (four items, α .83), and trust in fellow citizens (six items, α .67).

A regression model containing only the constructs from the VBN theory explained ~14 per cent of the variance in the acceptability of an increased tax on gasoline (*Adj.* R^2= .138). The model explained slightly more variance with the addition of the three types of trust (*Adj.* R^2= .163). No further analysis of attitudinal factors is included in the study by Harring and Jagers (2013).

2.2.2 Studies that use parts of the value-belief-norm theory

In addition to the seven studies identified in section 2.2.1, ten studies have used at least one construct from the VBN theory (but not the whole theory), along with other attitudinal factors not included in the VBN theory to explain policy acceptability. The ten studies are described here. The details of which attitudinal factors are used in each study are provided in Table 1. Where the number of items used to measure a construct is not listed, it is one item. Cronbach's alpha (α) is quoted for a construct if it is quoted in the original article. Column six includes both the personal capabilities and contextual factors that were studied alongside attitudinal factors. Although these factors are not discussed in this section, they are described in section 2.3, and presented alongside attitudinal factors to provide extra detail for each study.

Table 1: Studies using some of the value-belief-norm theory constructs alongside other attitudinal factors to understand policy acceptability

Author(s) and year	*N*	Location and participants	Attitudinal factors (from the VBN)	Other attitudinal factors (not in the VBN)	Contextual factors or personal capabilities
Aini *et al.* (2013)	201	Malaysia, general public	PN (four items, α.72)	Attitude towards energy conservation (four items);	Causes (nine items); Impacts (seven items); Perceived efficacy (five items)
Eriksson *et al.* (2006)	S1:462 S2:460	Sweden, general public	NEP (15 items, α.77), AC (Five items, α.95), PN	Willingness to reduce car use; Perceived fairness (Three items); Effectiveness (Three items); Freedom; Reduced car use	N/A
Eriksson *et al.* (2008)	827	Sweden, general public	NEP (15 items α.76); AC (four items α.94); PN (two items α.83)	Effectiveness; Fairness (Two items)	N/A
Nilsson *et al.* (2004)	356	Sweden, public and private sector employees	Values - Altruistic (four items α.73); Biospheric (four items α.87, Egoistic (five items in two components α.70 & α.69);	N/A	Organisational norms (four items α.90); Internal organisational goals (two items, α.75); Contributing to environmentally sustainable society (three items α.68)
Nilsson *et al.* (2008)	103	Sweden, Industry leaders (but addressed as public)	Values – Altruistic (two items); Biospheric (two items) and Egoistic (five items); PN (four items α.73)	N/A	N/A
Rauwald and Moore (2002)	228	Trinidad, students	NEP - six items in two components (four items α.54; two items α.72)	Kellert (1980) Attitudes Scale - 20 items in four components (Moralistic α.85; Dominionistic α.63; Utilitarian α.66; Humanistic α.62)	N/A
	273	Dom. Rep, students			
	257	U.S., students			
Schade and Schlag (2003)	954	Greece, Italy, Germany, Norway, motorists	AR (six items in two groups (internal and external) α.74 and α.53)	Social norms (nine items in two groups α.60 and α.58); Problem perception (six items in two groups α.58 and α.72); Effectiveness; Outcome	Knowledge
Schwom *et al.* (2010)	316	U.S., general public	Values - 15 items (three traditional; three openness to change; three egoistic and nine altruistic); NEP - five items (α.78)	A qualitative description of reasons for support/rejection of policies	N/A
Thogerson & Noblet (2012)	613	U.S., general public	NEP - four items, plus two study specific NEP style items (α.84)	N/A	N/A
Zahran *et al.* (2006)	1093	U.S., general public	NEP - six items (α.73)	Risk perception (three items α.84); Assessment of competency of national agencies (three items α.85)	Network interest (four α.73); Physical location (GIS); Perceived efficacy (three α.67)

Table 1 shows a variety of attitudinal factors being used to understand acceptability of policy. The PN construct was used in four of the studies, with inconsistency in the numbers of items used (between one and four). The AC construct was used in two studies, both by Ericksson *et al.* (2006, 2008), once with four items and once with five items. The AR construct was the least used of the NAT constructs, used only once, by Schade and Schlag (2003). This is similar to the studies identified in section 2.2.1, where the AR construct was not used by Stern *et al.* (1999), Dietz *et al.* (2007) and Poortinga *et al.* (2012). It is not clear from the articles, whether AR was purposefully not measured, or measured but not reported. In two studies by Eriksson *et al.* (2006, 2008) the AC and PN constructs were used, but in both studies the AR construct was not. The NEP was used most frequently, in six studies, although the full 15-item NEP was only used in two studies. Values were also used in varying formations; Nilsson *et al.* (2004, 2008) measured altruistic, biospheric and egoistic value scales, whereas Schwom *et al.* (2010) measured traditional and openness to change values, as well as altruistic and egoistic value orientations.

A variety of attitudinal factors were measured that are not part of the VBN theory. 'Effectiveness' was used three times, and 'fairness' was used twice; both were used to understand transport policy acceptability. The social norms construct was studied once (Schade and Schlag, 2003). Both Aini *et al.* (2013) and Rauwald and Moore (2002) used an alternative theory of 'attitudes'. Aini *et al.* (2013) measured attitudes from Ajzen's version as used in the theory of planned behaviour (TPB) (Ajzen, 1991); whereas Rauwald and Moore (2002) used a 20-item measure, which has four components - moralistic, dominionistic, utilitarian and humanitarian, devised by Kellert (1980).

Table 2 shows the results from the studies included in Table 1. Although it is difficult to compare studies on a like-for-like basis, viewing the results of the studies in this way provides an indication of what may be expected when using parts of the VBN theory alongside other attitudinal factors to explain acceptability of policy. Values of R^2 *(or* adjusted R^2*),* indicating the total variance explained in policy acceptability by the attitudinal factors, are reported in the

table if they are reported in the original articles. Also quoted, where possible, are *F* values indicating how well the model 'fitted', and β coefficients, indicating the change in standard deviation in policy acceptability caused by a one standard deviation change in the attitudinal factors. Also quoted is *p*, which gives the probability of the value of the *t-statistic* being obtained.

The PN construct was used in four studies; on three occasions to understand acceptability of transport policies, and on one occasion to understand acceptability of climate change policies. The PN construct explained between 21 and 28 per cent of the variance in transport policy acceptability in Eriksson *et al.* (2006), and between 10 and 16 per cent of the variance in transport policy acceptability in Eriksson *et al.* (2008). In the other two studies, the PN construct was found to statistically significantly contribute to the explanation of policy acceptability, with coefficients of β ranging from .17 to .35 (Aini *et al.,* 2013; Nilsson *et al*., 2008).

The AC construct was used in two studies, both by Eriksson *et al.* (2006, 2008) to understand transport policy acceptability. In Eriksson *et al.* (2006), the AC construct explained 18 per cent of the variance in the policy acceptability, whereas in Eriksson *et al*. (2008) it explained only between six and eight per cent of the variance. β coefficients were reported in Eriksson *et al.* (2008) of between .20 and .29. On the one occasion in the ten studies that the AR construct was measured, it explained an additional 7 per cent of variance and the unstandardised coefficient was found to be significant at the 1 per cent level (*B* .078, *p*< .01) (Schade and Schlag, 2003).

When the full NEP was used in two of the 10 studies, it was found to have β coefficients of between .09 and .13 (Eriksson *et al.*, 2006; 2008). Neither study provided an analysis of the possible factors present in the 15 NEP items. In both studies however, Cronbach's alpha scores for the full 15-item scale were high (α.77 and α.76) (Eriksson *et al.,* 2006; 2008). When a smaller sample of the 15 NEP items was used in three of the six studies, the β coefficients were

reported as being between .19 and .41, and were always found to be statistically significant at the 1 per cent level.

The values scale also provided interesting results. Firstly, none of the four studies that sought to understand acceptability of transport policy measured values, whereas values were measured in three of the four studies of climate change policy acceptability. In Nilsson *et al.* (2004, 2008), coefficients of β of egoistic values were found not to be statistically significant for any of the eight policy proposals, but in Schwom *et al.* (2010), the coefficient of β for the egoistic values construct was found to be statistically significant at the 1 per cent level.

For seven of the eight policy proposals in Nilsson *et al.* (2004, 2008), the coefficients of β for the biospheric values construct were statistically significant at either the 5 or 1 per cent levels. In only one of the eight policy proposals was the coefficient of β found to be statistically significant for the altruistic values construct (Nilsson *et al.* 2004; 2008).

Of the other attitudinal factors used in the ten studies, there are a few points of interest. In Eriksson *et al.* (2006), 'willingness', 'fairness' and 'effectiveness' were found to have consistently high scores of adjusted R^2 in their understanding of transport policy acceptability. This was also the case for 'effectiveness' and 'fairness' in Eriksson *et al.* (2008), but was not the case for 'effectiveness' in Schade and Schlag (2003) where the scores were less than 5 per cent. The social norms construct used by Schade and Schlag (2003) had a strong relationship with policy acceptability, with R^2 scores of .215 and .301, both significant at the 1 per cent level.

Table 2: Results from studies using some of the value-belief-norm theory constructs alongside other attitudinal factors to understand policy acceptability

Author(s), year, policy area	Policies	Attitudinal Factors (from the VBN)	Other Attitudinal Factors (Not in the VBN)	Contextual Factors or Personal capabilities
Aini *et al.* (2013) - Transport	Acceptability of three technical transport measures (α.63, *Adj.*R^2=.29, *F*=17.84)	PN (β .31, *p*.001)	Attitude (β.09, *p*.248);	Causes (β.26, *p*.001); Impacts (β.05, *p*.591); Efficacy (β.15, *p*.070)
	Acceptability of six behavioural transport measures (α.76, *Adj.*R^2=.12, *F*=10.39)	PN (β .26, *p*.031)	Attitude (β.14, *p*.092);	Causes (β.06, *p*.521); Impacts (β.07, *p*.389); Efficacy (β.25, *p*.004)
Eriksson *et al.* (2006) - Transport	Acceptability of improved public transport (*Adj.*R^2 =.51(S1) and .49 (S2))	NEP (no figures); AC (*Adj.*R^2 = .18(S1) and .18(S2)); PN (*Adj.*R^2 =.21(S1) and .28(S2))	Willingness (*Adj.*R^2=.43(S1) and .42(S2)); Fairness (*Adj.*R^2=.35(S1) and .27(S2)); Effectiveness (*Adj.*R^2=.17(S1) and .47(S2)); Freedom (*Adj.*R^2=.01(S1) and .02(S2)); Own reduction (*Adj.*R^2=.18(S1) and .21(S2))	N/A
	Acceptability of providing information (*Adj.*R^2 =.53(S1) and .57 (S2))	NEP (no figures); AC (*Adj.*R^2 = .18(S1) and .18(S2)); PN (*Adj.*R^2 =.21(S1) and .28(S2))	Willingness (*Adj.*R^2=.43(S1) and .42(S2)); Fairness (*Adj.*R^2=.22(S1) and .22(S2)); Effectiveness (*Adj.*R^2=.38(S1) and .32(S2)); Freedom (*Adj.*R^2=.01(S1) and .01(S2)); Own reduction (*Adj.*R^2=.07(S1) and .11(S2))	N/A
	Acceptability of raising taxes on fuel (*Adj.*R^2=.49(S1) and .51 (S2))	NEP (no figures); AC (*Adj.*R^2=.18(S1) and .18(S2)); PN (*Adj.*R^2=.21(S1) and .28(S2))	Willingness (*Adj.*R^2=.43(S1) and .42(S2)); Fairness (*Adj.*R^2 =.19(S1) and .24(S2)); Effectiveness (*Adj.*R^2=.30(S1) and .39(S2)); Freedom (*Adj.*R^2=.02(S1) and .04(S2)); Own reduction (*Adj.*R^2=.08(S1) and .15(S2))	N/A
Eriksson *et al.* (2008) - Transport	Acceptability of improved public transport	NEP (β.10); AC (β.26; *Adj.*R^2 = .06); PN (β.05)	Effectiveness (β.69; *Adj.*R^2=.34); Fairness (β.52; Adj.R^2=.52)	N/A
	Acceptability of subsidising renewable fuel	NEP (β.10); AC (β.24; *Adj.*R^2 = .08); PN (β.07)	Effectiveness (β.71; *Adj.*R^2=.33); Fairness (β.55; Adj.R^2=.55)	N/A
	Acceptability of raising taxes on fuel	NEP (β.09); AC (β.20); PN (β.24; *Adj.*R^2=.16)	Effectiveness (β.48; *Adj.*R^2=.25); Fairness (β.57; Adj.R^2=.57)	N/A
	Package 1 (Raise tax + improve public transport)	NEP (β.13); AC (β.29); PN (β.19; *Adj.*R^2=.13)	Effectiveness (β.55; *Adj.*R^2=.25); Fairness (β.57; Adj.R^2=.57)	N/A
	Package 2 (Raise tax + subsidise renewable fuel)	NEP (β.11); AC (β.26); PN (β.20; *Adj.R2*=.10)	Effectiveness (β.59; *Adj.R2*=.27); Fairness (β.58; Adj.R2=.58)	N/A

Nilsson *et al.* (2004) – Climate change	Acceptability of informational strategies (Total effects model R^2 =.14)	Direct effects model: Altruism (β-.04, n.s.); Biospherism (β.22, *p*<.05); Egoism (β.05, n.s. & β-.07, n.s.)	N/A	Direct effects model: Organisational norms (β.29, *p*<.01); Internal organisational goals (β-.14, n.s.); External organisational goals (β.12, n.s.)
	Acceptability of providing subsidies (Total effects model R^2 =.24)	Direct effects model: Altruism (β.20, *p*<.05); Biospherism (β.26, *p*<.01); Egoism (β-.02, n.s. & β-.04, n.s.)	N/A	Direct effects model: Organisational norms (β.29, *p*<.01); Internal organisational goals (β-.23, *p*<.01); External organisational goals (β.28, *p*<.01)
	Acceptability of increased taxes (Total effects model R^2 =.34)	Direct effects model: Altruism (β.03, n.s.); Biospherism (β.36, *p*<.05); Egoism (β.09,n.s. & β-.14,n.s.)	N/A	Direct effects model: Organisational norms (β.37, *p*<.01); Internal organisational goals (β-.33, *p*<.01); External organisational goals (β.22, *p*<.01)
	Acceptability of prohibition (Total effects model R^2 =.17)	Direct effects model: Altruism (β.05, n.s.); Biospherism (β.27, *p*<.01); Egoism (β.13, n.s. & β-.05, n.s.)	N/A	Direct effects model: Organisational norms (β.25, *p*<.05); Internal organisational goals (β-.20, *p*<.05); External organisational goals (β.15, n.s.)
Nilsson *et al.* (2008) – Climate change	Acceptability of informational strategies (Climate change) (Total effects model R^2 =.20, *p*<.01)	Direct effects model: Altruism (β-.04, n.s.); Biospherism (β.24, *p*<.05); Egoism (β-.03, n.s. & β-.15, n.s.); PN (β.35, *p*<.01)	N/A	N/A
	Acceptability of providing subsidies (Total effects model R^2 =.20, *p*<.01)	Direct effects model: Altruism (β.11, *n.s.*); Biospherism (β.16, *n.s.*); Egoism (β-.00, n.s. & β-.17, n.s.) PN (β.17, p<.01)	N/A	N/A
	Acceptability of increased taxes (Total effects model R^2 =.23, *p*<.05)	Direct effects model: Altruism (β.20, n.s.); Biospherism (β.34, *p*<.01); Egoism (β.06,n.s. & β.16,n.s.) PN (β.24, p<.01)	N/A	N/A
	Acceptability of prohibition (Total effects model R^2 =.30, *p*<.01)	Direct effects model: Altruism (β.07, n.s.); Biospherism (β.36, *p*<.01); Egoism (β.05, n.s. & β-.13, n.s.) PN (β.30, p<.01)	N/A	N/A

	Trinidad	Acceptability of Tax incentives (R^2 .054, β .18, *F(7,184)*=1.49)	NEP - Env (*r*-.167, *p*<.05); NEP - Rule (*r*.038, n.s.)	Moralistic (*r*-.042, n.s.); Dominionistic (*r*-.029, n.s.); Utilitarian (*r*.107, n.s.); Humanistic (*r*.039, n.s.)	N/A
	Trinidad	Acceptability of reduced hunting/timber opportunities (R^2 .222, β .192, *F*(7,182)=7.43)	NEP – Env (*r*-.111, *p*<.05); NEP - Rule (*r*.145, n.s.)	Moralistic (*r.031*, n.s.); Dominionistic (*r*.058, n.s.); Utilitarian (*r*.284, *p*<.001); Humanistic (*r*-.025, n.s.)	N/A
	Trinidad	Acceptability of establishing national parks (R^2 .119, β .085, *F*(7,184)=3.54)	NEP - Env (*r-.204*, *p*<.01); NEP – Rule (*r*.053, n.s.)	Moralistic (*r-.021*, n.s.); Dominionistic (*r*-.004, n.s.); Utilitarian (*r*.228, *p*<.01); Humanistic (*r*.045, n.s.)	N/A
	Dom. Republic	Acceptability of Tax incentives (R^2 .027, β -.002, *F(7,240)*=0.94)	NEP - Env (*r*-.035, n.s.); NEP - Rule (*r*.040, n.s.)	Moralistic (*r*-.023, n.s.); Dominionistic (*r*-.004, n.s.); Utilitarian (*r*.100, n.s.); Humanistic (*r*-.055, n.s.)	N/A
	Dom. Republic	Acceptability of reduced hunting/timber opportunities (R^2 .051, β .23, *F*(7,241)=1.85)	NEP - Env (*r*-.135, *p*<.05); NEP - Rule (*r*.064, n.s.)	Moralistic (*r*-.058, n.s.); Dominionistic (*r*-.032, n.s.); Utilitarian (*r*.096, n.s.); Humanistic (*r*.158, *p*<.05)	N/A
Rauwald & Moore (2002) – Env. protection	Dom. Republic	Acceptability of establishing stricter laws (R^2 .115, β .089, *F(7,241)*=4.47)	NEP - Env (*r*-.120, n.s.); NEP - Rule (*r*-.065, n.s.)	Moralistic (*r*-.171, *p*<.01); Dominionistic (*r*-.041, n.s.); Utilitarian (*r*.245, *p*<.001); Humanistic (*r*-.001, n.s.)	N/A
	U.S.	Acceptability of Tax incentives (R^2 .165, β .141, *F(7,243)*=6.86)	NEP - Env (*r*-.198, *p*<.01); NEP - Rule (*r*-.022, n.s.)	Moralistic (*r*-.126, n.s.); Dominionistic (*r*-.008, n.s.); Utilitarian (*r*.186, *p*<.01); Humanistic (*r*-.100, n.s.)	N/A
	U.S.	Acceptability of reduced hunting/timber opportunities (R^2 .207, β .184, *F*(7,243)=9.04)	NEP - Env (*r*-.135, *p*<.05); NEP – Rule (*r*.089, n.s.)	Moralistic (*r*-.162, *p*<.05); Dominionistic (*r*.186, *p*<.01); Utilitarian (*r*.147, *p*<.05); Humanistic (*r*.003, n.s.)	N/A
	U.S.	Acceptability of establishing national parks (R^2 .198, β .175, *F*(7,243)=8.55)	NEP - Env (*r*-.084, n.s.); NEP - Rule (*r*.020, n.s.)	Moralistic (*r*-.194, p<.01); Dominionistic (*r*-.141, p<.05); Utilitarian (*r*.246, *p*<.001); Humanistic (*r*-.124, n.s.)	N/A
	U.S.	Acceptability of establishing stricter laws (R^2 .394, β .376, *F(7,243)*=22.5)	NEP - Env (*r*-.275, *p*<.001); NEP - Rule (*r*.017, n.s.)	Moralistic (*r*-.216, p<.001); Dominionistic (*r*.020, n.s.); Utilitarian (*r*.328, *p*<.001); Humanistic (*r*-.001, n.s.)	N/A

Schade and Schlag (2003) - Transport	Road pricing strategy A	AR (Internal) (ΔR^2 .007, B.078, p<.01, β.088)	Social norm (R^2.215, B.355, p<.01, β.354); Problem perception (not reported); Effectiveness (ΔR^2.047, B.189, p<.01, β.207); Outcome (ΔR^2.037, B.227, p<.01, β.203)	Knowledge (ΔR^2.004, B.074, p<.05, β.066)
	Road pricing strategy B		Social norm (R^2.301, B.364, p<.01, β.378); Problem perception (not reported); Effectiveness (ΔR^2.046, B.206, p<.01, β.207); Outcome (ΔR^2.034, B.224, p<.01, β.214)	Knowledge (not reported)
Schwom *et al.* (2010) – Climate change	Eight items to reduce use of fossil fuels (α.89, Model 1: R^2.45; Model 2 R^2.51; Model 3 R^2.52)	Model 1 (direct): Traditionalism (β-.18, B-.15, p<.05); Open to change (β-.06, B-.07, n.s.); Egoism (β-.01, B.01, n.s.); Altruism (β.27, B.28, p<.01); NEP (β.41, B.40, p<.001)	Model 2 (direct): Economic (β-.15, B-.12, p<.05); Political (β-.14, B-.12, p<.05); Technological (β.06, B.08, n.s.); Moral (β.15, B.12, p<.05); Model 3 (direct): Cost to self (β-.14, B-.19, p<.05); Cost to others (β-.07, B-.08, n.s.); Policy objections (β-.12, B-.11, n.s.);Technological (β.07, B.09, n.s.); Environmental protection (β.18, B.17, p<.01); Moral responsibility (β-.01, B-.01, n.s.)	N/A
Thogerson & Noblet (2012) – Wind power	Acceptance of wind power (α.95, R^2.23) (Also measured Green consumerism (α.65, R^2.18) to assess spillover effects)	Direct: NEP (β.35, B.50, p<.001); Green consumerism (β.21, B.50, p<.001)	N/A	N/A
Zahran *et al.* (2006) – Climate change	Eleven items of climate change policy support (α.86, *Adj.*R^2.419, F=25.933)	NEP (β.19, B.18, p<.001)	Risk perception (β.165, B.244, p<.001); Agency competence (β.027, B.124, p<.001)	Network interest (β.073, B.069, p.083); Perceived efficacy (β.159, B.191, p<.001)

2.2.3 Studies that use other theories of behaviour

In the previous section, ten studies were reviewed that had used at least one construct from the VBN theory, alongside other attitudinal factors to explain acceptability of policy. In this section, eight studies that have used attitudinal factors, none of which are included in the VBN, are described. A summary of the studies is shown in Table 3. As with Table 1, where the number of items used to measure a construct is not listed, it is one item. Cronbach's alpha (α) is quoted for a construct if it is quoted in the original article. Column five includes both the personal capabilities and contextual factors that were studied alongside attitudinal factors. Again, although they are not covered in this section, they are described in section 2.3, and presented alongside attitudinal factors to provide extra detail for each study. Table 4 provides the results from the studies presented in Table 3, quoting the same statistics, where possible, that were included in Table 2.

Table 3: Studies using attitudinal factors that are not from the value-belief-norm theory to understand policy acceptability

Author(s) and year	*N*	Location and participants	Other Attitudinal Factors (not in the VBN)	Contextual Factors or Personal capabilities
Jakobsson *et al.* (2000)	524	Sweden, general public	Expectation of others (five items); Intention (five items); Fairness (five items); Freedom (five items);	N/A
Kalbekken and Saelen (2011)	1177	Norway, general public	Beliefs about consequences: to self (fuel consumption, income), to environment (environmental concern, effectiveness), to others (regressiveness, income elasticity); socio-political (trust in government)	N/A
Kim *et al.* (2013)	168	U.S and U.K., students	Fairness (three items); Freedom; Effectiveness; Awareness (three items); Trust (two items)	Car ownership
Loukopoulos *et al.* (2005)	291	Sweden, university staff	Environmental concern (six items α.86); Environmental quality (four items α.66); Travel costs	Car accessibility (two items α.70), Non-auto accessibility (three items α.83)
Schuitema *et al.* (2010a)	507	Netherlands, general public	Expected effects on car use, congestion and environmental problems	N/A
Schuitema *et al.* (2010b)	143	Sweden, general public	Beliefs about congestion, parking problems, pollution, car use, travel costs, public transport	Percentage of car trips
Tobler *et al.* (2012)	916	Switzerland, general public	Perceived climate benefit (24 items α.75); Perceived costs (22 items α.73); Concern about climate change (four items α.83); Feeling of powerlessness (five items α.71); Scepticism (seven items α.83)	N/A
Wang *et al.* (2012)	749	China, general public	Awareness of energy saving and environmental problems (three items α.71); Cost (three items α.74); Social environmental impacts (three items α.73);	Information (three items α.72); Experience (three items α.71)

Across the eight studies, a variety of attitudinal factors were used to understand acceptability of policies. Of the eight studies shown in Table 3 and Table 4, six studies are seeking to understand acceptability of transport policies. Despite this, there is considerable variability in the attitudinal factors selected as predictors of policy acceptability.

Perceptions of the 'impacts' of the proposed policies on environmental problems and climate change were included in five of the studies. In two studies (Schuitema *et al.,* 2010a; Tobler *et al.,* 2012), where impacts were conceptualised as 'expected effects on the environment' and 'perceived climate benefit' respectively, they were found to be statistically significantly related to transport policy acceptability (β.22 p<.001, β.60 p<.001; and β.68 p<.001, β.6 p<.001, respectively). In the studies by Kalbekken and Saelen (2011) and by Loukopoulos *et al.* (2005) impacts explained a moderate amount of variance in transport policy acceptability (R^2.17 and R^2.07, respectively). However, in the study by Schuitema *et al.* (2010b) where impacts were conceptualised as 'beliefs about pollution', it was found not to be a statistically significant predictor at all (β.16, p.276; β.14, p.310).

In line with the transport studies included in Table 1 and Table 2, fairness, freedom and effectiveness were again measured to understand transport policy acceptability. In the four models proposed by Kim *et al.* (2013), three types of fairness (scenario, procedural and distributive) were consistently found to have statistically significant relationships with policy acceptability. Beliefs about freedom also had a statistically significant (negative) relationship with policy acceptability – the more that a policy infringed on an individual's freedom, the less acceptable it became (Kim *et al.,* 2013). Jakobsson *et al.* (2000) also measured fairness and freedom, but found much weaker relationships than Kim *et al.* (2013), with coefficients for fairness β.055 and freedom β-.012 very low.

Although effectiveness was measured explicitly in only one study (Kim *et al.*, 2013), beliefs about congestion were used in two studies (Schuitema *et al.*, 2010a, 2010b) and parking problems in one study (Schuitema *et al*., 2010b),

with both considered as proxies for effectiveness. Shuitema *et al.* (2010a; 2010b) found beliefs about congestion to be a contributing factor in their study of acceptability of toll and Km charges. In the same studies though, curiously, beliefs about congestion were found not to be contributing factors in the models to explain acceptability of congestion charging. In both Shuitema *et al.* (2010a; 2010b), beliefs about parking problems were only found to be significant predictors in the study of congestion charging, post introduction of the scheme (β.25, *p*.025). Effectiveness was found to be a significant predictor by Kim *et al.* (2013) for three of the four policy proposals.

Concern for the environment and about climate change was used in two studies (Loukopoulos *et al.,* 2005; Tobler *et al.,* 2012). In both studies, β coefficients were small but statistically significant (β.06 *p*<.05; β.10 *p*<.05).

Four studies used individual perceptions of costs in their models (Loukopoulos *et al.,* 2005; Schuitema *et al.,* 2010b; Tobler *et al.,* 2012; Wang *et al.,* 2012) covering transport, climate change and domestic energy policy acceptability. In three of the four studies, a negative relationship was found - acceptability of policy increases when concern about cost decreases. In three of the five models in these three studies, costs were perceived to be a significant predictor of policy acceptability. In the domestic energy study, and in the post-congestion charge model, costs were not perceived to be a significant (Schuitema *et al.,* 2010b; Wang *et al.,* 2012).

Table 4: Results from studies using attitudinal factors that are not from the value-belief-norm theory to understand policy acceptability

Author(s) and year	Policies	Attitudinal Factors (Not in the VBN)	Contextual or Personal capabilities
Jakobsson *et al.* (2000) (Transport)	Acceptability of two road pricing proposals, each with five sub-questions relating to percentage increases	Expectation (not reported); Intention (not reported); Fairness (β.055); Freedom (β-.012)	N/A
Kalbekken and Saelen (2011) (Transport)	Acceptability of five proposals to change fuel tax rate	Beliefs about consequences: to self (pseudo R^2.05); to environment (pseudo R^2.17); to others (pseudo R^2.10); socio-political (pseudo R^2.08)	N/A
Kim *et al.* (2013) (Transport & Environmental tax)	(U.S. sample) Acceptability of road pricing (R^2.32)	Scenario fairness (*r*.82, *p*<.01); Procedural fairness (*r*.77, *p*<.01); Distributive fairness (*r*.67, *p*<.01); Freedom (*r*-.41, *p*<.01); Effectiveness (*r*.51, *p*<.01); Social problem (*r*.11, n.s.); Self problem (*r*.27, *p*<.01); Personal problem (*r*.20, n.s.); General trust (*r*.07, n.s.); Specific trust (*r*.66, *p*<.01)	Car ownership (*r*.10, n.s.)
	(U.S. sample) Acceptability of environmental taxation (R^2.29)	Scenario fairness (*r*.70, *p*<.01); Procedural fairness (*r*.59, *p*<.01); Distributive fairness (*r*.58, *p*<.01); Freedom (*r*-.44, *p*<.01); Effectiveness (*r*.43, n.s.); Social problem (*r*.32, *p*<.01); Self problem (*r*.23, *p*<.05); Personal problem (*r*.04, n.s.); General trust (*r*.28, *p*<.01); Specific trust (*r*.59, *p*<.01)	N/A
	(U.K. sample) Acceptability of road pricing (R^2.53)	Scenario fairness (*r*.91, *p*<.01); Procedural fairness (*r*.80, *p*<.01); Distributive fairness (*r*.42, *p*<.01); Freedom (*r*-.74, *p*<.01); Effectiveness (*r*.56, *p*<.01); Social problem (*r*.25, *p*<.05); Self problem (*r*.36, *p*<.01); Personal problem (*r*.37, n.s.); General trust (*r*.20, *p*<.05); Specific trust (*r*.63, *p*<.01)	Car ownership (r-.42, *p*<.01)
	(U.K. sample) Acceptability of environmental taxation (R^2.29)	Scenario fairness (*r*.73, *p*<.01); Procedural fairness (*r*.66, *p*<.01); Distributive fairness (*r*.28, *p*<.05); Freedom (*r*-.45, *p*<.01); Effectiveness (*r*.69, *p*<.01); Social problem (*r*.38, *p*<.01); Self problem (*r*.04, *n.s.*); Personal problem (*r*.16, n.s.); General trust (*r*.14, *n.s.*); Specific trust (*r*.51, *n.s.*)	N/A

Loukopoulos *et al.* (2005) (Transport)	Acceptability of road pricing, prohibition and marketing (*Adj.*R^2=.431, *F*(35,866)=101.48, *p*<.001)	Environmental concern (*β*.10, *p*.015), Environmental quality (*Adj.*R^2.074, *F*(11,861) 7.37, *p*<.001 (road pricing, env. concern, prohibition as predictors); Travel costs (*Adj.*R^2.033, *F*(11,861) 3.70, *p*<.001 (road pricing, env. concern, prohibition as predictors)	Car accessibility (*Adj.*R^2.23, *F*(11,861) 24.73 *p*<.001 (road pricing, env. concern, prohibition, car ownership as predictors); Non-auto accessibility (*Adj.*R^2.181, *F*(11,861) 18.49, *p*<.001 (env. concern, prohibition as predictors)
Schuitema *et al.* (2010a) (Transport)	Acceptability of toll charge	Expected effects on: Car use (β.05, n.s.; r.22, *p*<.001); Congestion (β.42, *p*<.001; r.53, *p*<.001); Environment (β.22, p<.001; r.43, *p*<.001)	N/A
	Acceptability of Km charge	Expected effects on: Car use (β-.05, n.s.; r.17, *p*<.001); Congestion (β.15, n.s.; r.38, *p*<.001); Environment (β.60, *p*<.001; r.49, *p*<.001)	N/A
Schuitema *et al.* (2010b) (Transport)	Acceptability of congestion charge (pre trial)(*F*(7,127)=14.03, R^2.44)	Beliefs about: Congestion (β.27, *p*.07), Parking problems (β.04, *p*.733), Pollution (β.16, *p*.276), Own car use (β.28, *p*.000), Travel costs (β-.16, *p*.027), Public transport (β-.09, *p*.233)	N/A
	Acceptance of congestion charge (post trial)(*F*(7,101)=8.35, R^2.37)	Beliefs about: Congestion (β.14, *p*.345), Parking problems (β.25, *p*.025), Pollution (β.14, *p*.310), Own car use (β.25, *p*.004), Travel costs (β-.03, *p*.705), Public transport (β-.08, *p*.364)	N/A
Tobler *et al.* (2012) (Climate change)	Acceptability of supportive measures (nine items, α.83, R^2.68)	Climate benefit (β.68, *p*<.001), Perceived costs (β-.10, *p*<.001), Concern (β.08, *p*<.01), Scepticism (β-.07, n.s.), Powerlessness (β.03, n.s.)	N/A
	Acceptability of CO_2 restrictions (nine items, α.85, R^2.74)	Climate benefit (β.61, *p*<.001), Perceived costs (β-.29, *p*<.001), Concern (β.06, n.s.), Scepticism (β-.01, n.s.), Powerlessness (β.02, n.s.)	N/A
Wang *et al.* (2012) (Domestic energy)	Tiered electricity pricing	Awareness (β.529, *p*<.001), Cost (β-.064, n.s.), Social environmental impacts (β.554, *p*<.001)	Information (β.270, *p*.031), Experience (β.064, n.s.)

2.3 Personal capabilities and contextual factors

In section 2.2, 25 studies that had used attitudinal factors to explain acceptability of policy were described. Of those 25 studies, six also sought to explain acceptability of policies by understanding personal capabilities and contextual factors. These six studies are further described in this section. No additional articles were identified that had measured personal capabilities and contextual factors, without measuring attitudinal factors. Three of the six studies were seeking to understand acceptability of transport related policies.

There is some overlap across the six articles in terms of personal capabilities or contextual factors used to understand policy acceptability. In three articles 'knowledge' (or information) is studied (Aini *et al.*, 2013; Schade and Schlag, 2003, Wang *et al.,* 2012). Aini *et al.* (2013) study both knowledge of impacts (of climate change) and knowledge of causes (of climate change), only finding knowledge of causes to be statistically significantly related to acceptability of three technical policies (β.26, *p*.001). Schade and Schlag (2003) found knowledge to be statistically significantly related to one of two road pricing strategies (ΔR^2.004, B.074, *p*<.05, β.066). Wang *et al.* (2012) found information to be statistically significantly related to acceptability of tiered electricity pricing (β.270, *p*.031).

Perceived efficacy was used in two studies, once to understand acceptability of transport policies, and once to understand acceptability of climate change policy (Aini *et al.,* 2013; Zahran *et al.,* 2006). In both models used by Aini *et al.* (2013), perceived efficacy was not found to be statistically significantly related to acceptability of transport policy, but in Zahran *et al.* (2006) it was found to be a statistically significant predictor of climate change policy (β.159, B.191, *p*<.001).

In Zahran *et al.* (2006) network interest was not found to be a statistically significantly predictor of climate change policy acceptability. The network interest construct used by Zahran *et al.* (2006) asks for individuals to conceptualise social norms, but does it in a very specific way, asking for details of discussions with friends and family, and for opinions offered or asked for

(β.073, B.069, *p*.083). In Chapter 3, section 3.3, this type of contextual factor influencing behaviour is explored further.

Finally, in Nilsson *et al.* (2004), organisational norms and internal and external goals were studied to predict climate change policy acceptability. Organisational norms were found to be a statistically significant predictor of acceptability of all four climate change policy types, with internal goals a significant predictor of three of the policies and external goals a significant predictor of two of the four policy types.

2.4 Policy characteristics

Stern's (2000) classification of factors affecting environmentally significant behaviour (ESB) has been used thus far in this chapter as a structure for understanding the various influences that affect policy acceptability. Whilst this has provided for a useful structured review of literature, it cannot be assumed that the four causal variables identified by Stern (2000) cover every aspect influencing acceptability of policies.

In the literature searching exercise described in section 2.1.2, three articles were identified that sought to understand policy acceptability by focussing on the *characteristics of the policy*, rather than any of Stern's (2000) four causal variables. In each of these three studies, a number of policy proposals are put forward, with the goal of these studies to understand which policies are more acceptable than the others and which characteristics of the policy affect its acceptability. These three studies are reviewed here. (Note: the Steg *et al.,* (2006) study referenced here uses the same data set as used in Steg *et al.,* (2005)).

In Steg *et al.* (2006) acceptability judgements for 16 policy proposals are studied. These 16 proposals cover four characteristics of policy – push vs. pull, efficiency vs. curtailment, direct vs. indirect and within vs. outside. Push vs. pull refers to the coerciveness of the policy, essentially penalty vs. reward, and is also included in the two other studies of policy characteristics (e.g. Schuitema *et*

al., 2011; De Groot and Schuitema, 2012). Efficiency vs. curtailment refers to the type of energy saving behaviour, direct vs. indirect refers to the type of energy use targeted, and within vs. outside refers to the allocation of revenues raised from the policy proposal.

Steg *et al.* (2006) studied acceptability of policies aimed at reducing household CO_2 emissions (*N*=112, Netherlands, general public). They found that pull (reward) measures ($\bar{x}$=3.69) are more acceptable than push (penalty) measures ($\bar{x}$=3.32)(five-point Likert scale). Although mean scores of acceptability revealed only a small difference, part-worth scores from conjoint analysis revealed that this difference is statistically significant (*t*(110)=-6.39, *p*<.001, 95 per cent CI of the difference .25, .48). Efficiency measures ($\bar{x}$=3.64) were also viewed as more acceptable than curtailment ($\bar{x}$=3.37) and statistically significantly different (*t*(110)6.55, *p*<.001, 95 per cent CI of the difference .19, .35).

Direct measures ($\bar{x}$=3.55) were viewed very slightly in favour of indirect ($\bar{x}$=3.46) measures (*t*(110)=2.36, *p*.02, 95 per cent CI of the difference .01, .17). The allocation of revenue (within vs. outside) was combined with push vs. pull. The push and pull characteristics were of more importance in explaining acceptability than the within and outside characteristics – i.e. within and outside measures were found to be more acceptable when combined with pull measures, than when combined with push measures.

De Groot and Schuitema (2012) studied transport policy acceptability (*N*=123, UK, general public). As with Steg *et al*. (2006), push vs. pull policy characteristics were compared by De Groot and Schuitema (2012). Also compared, was the acceptability of policies targeting high cost vs. low cost behaviours. As with Steg *et al.* (2006), pull measures ($\bar{x}$=5.9) were found to be more acceptable than push measures ($\bar{x}$=4.7) (seven-point Likert scale). This difference in acceptability is statistically significant (*F*(1,119)=100.27, *p*<.001, η^2=.46), as is the difference in the acceptability of tackling high cost ($\bar{x}$=4.6) vs. low cost ($\bar{x}$=6.0) behaviours (*F*(1,119)=77.71, *p*<.001, η^2=.40). Similar to the study by Steg *et al.* (2006), De Groot and Schuitema (2012) combined push vs.

pull characteristics with high vs. low cost characteristics. Of the four combinations of policies, the two low cost measures are the most acceptable (combined with: pull $\overline{x}$=6.5; push $\overline{x}$=5.6) followed by the two high cost (combined with: pull $\overline{x}$=5.3; push $\overline{x}$=3.8). This finding suggests that the cost characteristics of the policy are more important in determining acceptability than the coercion characteristics of the policy (De Groot and Schuitema, 2012).

Schuitema *et al.* (2011) studied acceptability of car use and car ownership policies (*N*=101, Netherlands, general public). As with Steg *et al.* (2006) and De Groot and Schuitema (2012), push (car use $\overline{x}$=4.0; car ownership $\overline{x}$=4.7) and pull (car use $\overline{x}$=4.3; car ownership $\overline{x}$=4.9) characteristics were compared (seven-point Likert scale).

Although policies with pull characteristics were found to be more acceptable than policies with push characteristics, policies that targeted car ownership were universally found to be more acceptable than policies that targeted car usage. Differences in acceptability were found to be statistically significant when comparing car use vs. car ownership policy proposals ($F(1,100)=19.86$, $p<.001$). Policies that combined push and pull characteristics were found to be more acceptable than policies that either pushed or pulled (combined car use $\overline{x}$=4.3; combined car ownership $\overline{x}$=5.1). Differences in acceptability when comparing push vs. pull vs. a combination of push and pull policies was also found to be statistically significant ($F(2,99)=7.42$, $p<.001$).

2.5 Discussion

Twenty-eight studies have been reviewed in this chapter, each seeking to understand and explain policy acceptability. All 28 studies have used survey data collection methods and quantitative data analysis to assess policy acceptability.

The 28 articles reviewed here have, in truth, only provided a framework for understanding influences on acceptability of policy. The diversity across the studies makes it difficult to draw conclusions on the best approach for this

study. In research there needs to be a balance of consistency and innovation; the 28 studies included for review here have tended to lean towards innovation over consistency.

Across 25 of the 28 studies there is a broad use of attitudinal factors to explain policy acceptability. If quantity of studies gives any indication of appropriate factors used to explain policy acceptability, then the use of attitudinal factors by 25 studies suggests that this is a fruitful path; only seven studies identified contextual or personal capabilities as influencers of policy acceptability, and no studies identified habits. Indeed, when contextual and personal capabilities were measured, they were used alongside attitudinal factors. In the three studies where attitudinal factors were not identified as predictors of policy acceptability, policy characteristics were compared.

2.5.1 The use of attitudinal factors

Where there is consistency in the broad use in the 25 studies of attitudinal factors, there is inconsistency in the attitudinal factors used. In section 2.2.1, seven studies were identified that claimed to use the VBN theory - five of the seven make reference to using the VBN theory in the abstract of their article. However, only one of the seven actually used the full VBN theory as originally intended and without omitting or adding in alternative attitudinal constructs. All of the other six articles omit VBN constructs, and in two studies alternative predictors are added in, some of which are added in in place of VBN constructs. Whilst the need for a tailored approach to explaining behaviour is understood, the need to repeatedly test the relationships between attitudinal constructs and their ability to explain behaviour should not be sacrificed. Indeed, it should be considered imperative that studies are repeated to gather cumulative understanding, much in the way that the Schwartz values scale (Schwartz, 1992, 1994) was tested in 97 samples in 44 countries, with 25,863 participants.

The preference for the use of adapted versions of the VBN theory is curious given the success when using the original version. In Stern *et al.* (1999), the VBN theory was found to be the best predictor of environmentally significant

behaviour when compared with other theories, and also found to be best at predicting policy acceptability (R^2= .346). Six years later, in Steg *et al.* (2005), the full VBN theory was found to be a successful predictor of policy acceptability (R^2= .32). The constructs in the VBN theory were found to be sufficiently related to each other, supporting a fully mediated theory.

Despite the obvious successes of Stern and Steg and colleagues, when an adapted version of the VBN theory has been used, it has also proven to be successful. In the five articles that have used an adapted version of the VBN theory (Dietz *et al.,* 2007; Poortinga *et al.,* 2012; De Groot *et al.,* 2008; Jakovcevic and Steg, 2013; Harring and Jagers, 2013), their proposed models have successfully explained acceptability of transport, domestic energy and climate change policy's (R^2= .66, .65 & .17, .32, .14 and .14 respectively).

A frequent alteration made to the VBN theory is the omission of the ascription of responsibility (AR) construct (omitted from Stern *et al*., 1999; Dietz *et al.,* 2007; and Poortinga *et al.,* 2012). When it was included (e.g. Steg *et al.,* 2005; De Groot *et al.,* 2008; Jakovcevic and Steg, 2013; and Harring and Jagers, 2013), although it may not have significantly contributed directly to the prediction of policy acceptability, in each it predicted variance in the personal norms construct (R^2= .32, .22, .31, N/A, respectively).

The NEP construct is also used inconsistently. In Steg *et al.* (2005), the full 15-item NEP was used and predicted 28 per cent of the variance in AC. In Stern *et al.* (1999) and Dietz *et al.* (2007), a shortened five-item NEP was used, whereas in Poortinga *et al.* (2012), De Groot *et al.* (2008) and Jakovcevic and Steg (2013), the NEP is omitted entirely.

One consistency is the use of the personal norms (PN) construct; used in all seven of the studies that used the VBN theory. Although Dietz *et al.* (2007) removed the PN construct from analysis because of problems of correlation with other VBN constructs it was used successfully in statistical analysis in each of the other six studies. On its own it explained 29 per cent of the variance in policy acceptability in the Steg *et al.* (2005) study.

Aside from the seven studies that use all or most of the VBN theory constructs, another 10 studies use one or two constructs from the VBN theory along with other attitudinal factors. In these 10 studies, there is even less consistency than there is in the seven that use the VBN theory. There is an inconsistency in the constructs that are used that are from the VBN theory; and there is an inconsistency in the additional attitudinal factors that are used alongside the VBN theory. This inconsistency is also true of the eight studies that use only attitudinal factors that are not part of the VBN theory. Whilst it has been useful to include these articles in the review provided here, they provide little in the way of further consistent evidence for understanding policy acceptability. The 18 articles do however highlight the emphasis that is placed upon innovation in this area, and the choices made by researchers to tailor their selection of attitudinal factors specifically for their study.

2.5.2 Other factors

Outside of the 'causal variables' approach suggested by Stern (2000), three articles were highlighted that had identified that the characteristics of policy were of importance in determining their acceptability. In these three articles, there are no 'causal variables' that can be understood in order to explain policy acceptability. Instead, several policy proposals are put forward with differing characteristics, and their acceptability compared.

In all three articles, the coerciveness of the proposals was an important factor in their acceptability. Policy proposals that rewarded good behaviour were universally found to be more acceptable than those policy proposals that sought to punish bad behaviour. Beyond policy coercion, policy costs and the types of behaviour that the policies sought to change were also found to be important factors affecting acceptability.

2.5.3 Implications for this study

The 28 articles reviewed here, although containing a considerable amount of variance and diversity in their approach to understanding policy acceptability,

have provided evidence to inform this study. It is clear that attitudinal factors are important. The VBN theory, an adapted version of it, or a small number of constructs from it, were used in 17 of the 28 studies identified here. The characteristics of policy also proved to be an important factor in determining their acceptability. Although this was only studied in a small number of articles, it appears to be a significant factor in determining acceptability.

This study will use the full VBN theory, as proposed by Stern *et al.* (1999) and as operationalised by Steg *et al.* (2005). This is objective 1:

> *To understand attitudinal factors influencing acceptability of greenhouse gas emissions reduction policies, using the value-belief-norm theory*

Using the full VBN theory will provide evidence comparable to that collected in the Stern *et al.* (1999) and Steg *et al.* (2005) studies, and begin to build some consistency in the use of the VBN theory to understand policy acceptability. Using the full VBN theory will also allow comparison on a construct-by-construct basis with the 10 studies that have used some but not all of the VBN theory constructs.

Using the full VBN theory will allow for a comparison of the findings from this study with five other studies that have used the full VBN theory, but to understand other types of environmentally significant behaviour (i.e. not policy acceptability) (e.g. Menzel and Bögeholz, 2009; Abrahamse and Steg, 2011; Jansson *et al.*, 2011; López-Mosquera and Sánchez, 2012; Sahin, 2013). This is objective 5:

> *To test the full value-belief-norm theory*

Also included in this study is a comparison of characteristics of policy. In addition to understanding attitudinal factors, several policies with differing characteristics will be proposed to further determine their importance with regards to acceptability.

2.6 Chapter Summary

In this chapter, studies of factors affecting acceptability of policies have been reviewed. The review followed the Stern (2000) classification of ‘causal influences’ on environmentally significant behaviour, as well as characteristics of policy that affect their acceptability. A total of 28 articles were included in the review, covering the period from 1999 to 2013. Most studies have been conducted in Northern Europe and the U.S, with many of them explaining acceptability of transport related policies.

The review led to two conclusions with implications for this research - that attitudinal factors and policy characteristics are important in determining the acceptability of policy proposals. The review also led to the development of two objectives; to understand attitudinal influences on acceptability judgements using the VBN theory, and to test the full VBN theory.

Chapter 3 Understanding social context

3.1 Introduction

Periodically, review articles are published that, rather than presenting new research, review the current state of a research field. These articles are particularly useful as they not only serve to highlight what is currently known within a field, and the typical methodological techniques used, but they also highlight concerns for future research to address. A number of review articles have been published in the area of environmental psychology and environmentally significant behaviour (ESB) (e.g. Stern, 1992, 2011; Bamberg & Moser, 2007; Lucas *et al.*, 2008; Steg & Vlek, 2009; Uzzell & Rahzel, 2009; Swim *et al.*, 2011).

A recurrent theme in these review articles is the recognition of the importance of social context in understanding attitudinal factors and behaviours. This is apparent in the review by Uzzell and Rahzel (2009:340) "we take as our starting point the theoretical proposition that individuals are the sum of their social relations", and in Stern (2011:305) "psychological research can help improve on standard policy models by showing empirically how the effects of policy interventions depend on social influences on behaviour" and in Swim *et al.* (2011:242) "human dimensions of climate change are inherently psychological and social" and "individual decisions are influenced by and operate through the immediate and distal physical and social contexts in which they are embedded" (Swim *et al.*, 2011:243).

Given the frequency of the attitudinal factors approach taken in most of the 28 articles reviewed in Chapter 2 for understanding policy acceptability, it would have been conceivable in this study to continue to develop this approach. However, this would have been to ignore the calls in the review articles acknowledging the importance of social context. Uzzell and Rahzel (2009:341) go on to criticise current research trends that take solely the attitudinal factors approach "while values and attitudes are clearly important in influencing

behaviour, values and attitudes are not formed in a social and cultural vacuum. They are embedded, nurtured and emerge from a social context".

This thesis acknowledges the criticism by Uzzell and Rahzel (2009), and the calls made in the seven review articles. This study seeks to extend the understanding of individual attitudinal factors influencing acceptability of policy by understanding the social context within which attitudinal factors form and exist. This is done by the use of social network analysis (SNA).

SNA is described in section 3.2, briefly introducing the language and techniques that are used in the field (section 3.2.1), and introducing the different types of studies that are common (section 3.2.2). Studies that have used SNA to understand behaviour are reviewed in section 3.3, covering those that have used SNA to understand ESB (section 3.3.1) and those that have covered non-ESB (section 3.3.2). This is followed by a review of studies that have used SNA to understand attitudes (section 3.4) and studies that have used ESB in organisations (section 3.5).

3.2 Social network analysis

SNA is a method and a tool with which social context and interpersonal influences can be understood. SNA focuses on individuals and their relationships with each other, seeking to explain a variety of social phenomena through a structural lens. This chapter starts with an introduction to SNA, the language and the techniques typically used. This is followed by examples from studies where an explanation of behaviour and/or attitudes is enhanced with a quantitative representation of social context and interpersonal influences, understood with SNA techniques.

3.2.1 An introduction to the techniques of social network analysis

Before articles using SNA are reviewed, it is worth describing some of the specialist language and techniques that are typically used. Fundamentally, network analysis is the study of 'ties' between 'nodes'. Nodes represent the

members of a network, with ties representing the relations between the nodes. For a *social* network, the nodes are individuals, and the relation between the individuals can be as diverse as can be imagined – sharing needles to inject drugs, smoking behaviour, kinship, attending the same university, working for the same employer, and so on. All of these relations could be applied to the same set of nodes. Where the network is *not social*, nodes can be as diverse as airports, cities, electricity sub-stations and so on, but the ties in these instances are typically much less diverse – motorways that link cities, flights that link airports, electricity cables that link substations and so on. In this thesis the focus is on social networks, whereby the nodes are people.

Methodological techniques in SNA fall into one of two main categories – studies are either of 'whole' or 'ego' networks. In whole network studies, a well-defined bounded group is studied. Typically, information from every individual in the group is collected. This information covers the relationships held by each network member with each other. The alternative is studying ego networks, and focuses only on one individual - ego - and the relations that they have in *their* network. Ego network analysis is used instead of whole network analysis when a group is not well defined, not bounded or the group is too large to guarantee that data will be provided by all group members.

For example, a whole network study would be the appropriate method for studying friendships in a university football team (there are probably less than 30 individuals in total, and it would not be too difficult to gather all of them together to undertake a data collection exercise), but not friendship across the whole of a university's students (~20,000 individuals). In the football team example, a relational tie question might be "with whom do you have a drink with, after playing a match?" All of the members of the team would respond by naming other players from within the football team with whom they have a drink with after the football match. The university football team manager might want to use this information to select a team captain, perhaps selecting the player that is most frequently selected by their fellow players.

The relational questions that elicit the names of network members are called ‘name generators’. There are a number of ways in which individuals elicit the names of individuals in their network, each with methodological considerations that affect the validity and reliability of the data gathered (Wasserman and Faust, 1994). Examples of approaches include the use of a ‘roster’ to prompt responses whereas not using a roster requires individuals to name others from memory. Individuals can be asked for a set number of others – this is called ‘fixed choice’ – i.e. name your three best friends, or, they can name as many others as they wish – ‘free choice’ – i.e. name your best friends. Individuals can be asked to rate or rank those who they name i.e. of your three best friends, which is your most favourite, and which is your least? Specialist terminology is used to label the individual that is responding to a name generator – ‘ego’ - and to label those that they name – ‘alters’.

3.2.2 Typology of studies using social network analysis

Growth in the use of social network analysis to provide an alternative but complementary perspective in social research has been exponential since the 1970’s (Borgatti and Foster, 2003). In Borgatti and Foster (2003) a structure is provided with which to classify studies that use social network analysis. Studies that focus on the *causes of networks* are differentiated from those that focus on the *consequences of networks*; *structuralist* studies which focus on an individual’s position in a network – similar positions cause similar outcomes are differentiated from *connectionist* studies where the focus is on connections in a network – interpersonal transmission of resources causes similar outcomes; studies that focus on *individuals* are differentiated from studies that focus on *pairs* of individuals or *whole* networks; and finally studies are differentiated on explanatory goals – differentiating between *performance* of individuals and *homogeneity* of individuals.

The framework for classifying studies of the consequences of networks is shown in Table 5 (*cf*. Borgatti and Foster, 2003). In this thesis, studies that focus on the *consequences* of networks, using network structure to determine

the *flow of resources* between *individuals* and the resulting level of *homogeneity,* will be covered. These studies fall under the 'contagion' category in Table 5. It is perceived that these studies will provide the most relevant information for understanding interpersonal influences on policy acceptability.

Table 5: Typology of research on consequences of network factors (*cf*. Borgatti and Foster, 2003)

	Social Capital **(performance variation)**	**Diffusion** **(social homogeneity)**
Structuralist (topology)	Structural capital	Environment shaping
Connectionist (flows)	Social access to resources	Contagion

The remainder of this chapter is separated into three sections. The first focuses on the applications of SNA to understanding behaviour (section 3.3). This is further separated into applications of SNA to understand behaviours that are environmentally significant (section 3.3.1), and also behaviours that are not considered to environmentally significant (section 3.3.2). The second section covers studies that have applied SNA to understand contagion in individual attitudes (section 3.4). Some of these studies are longitudinal, seeking to understand whether individuals select their network members based upon similar attitudes, or whether similar attitudes evolve as a result of their shared network membership. The final section details the studies of social networks that have been carried out in an organisational setting (section 3.5), as this is the context for this study.

3.2.3 Method for identifying relevant literature

Similarly to the method used to identify relevant literature in Chapter 2, the Science Direct and Web of Knowledge databases and search engines were

utilised. Search terms such as “social networks/social network analysis” and “environmentally significant behaviour/behaviour/attitudes” were used. Again, key articles were identified and forwards and backwards citation searches using Scopus identified further relevant literature. For section 3.5, the word ‘organisational’ was also added to searches. The search terms “environmentally significant behaviour/behaviour/attitudes were also used to search the journal ‘Social Networks’, published by Elsevier.

A total of 22 articles investigating social networks/social network analysis and environmentally significant behaviours/behaviour/attitudes were identified that collected empirical data. These 22 articles will inform the approach taken in this study.

Because of the diversity in the goals and approaches within the 22 studies included in this chapter, the description and review of their findings is less detailed than the approach taken in Chapter 2. Whereas in Chapter 2, there was sufficient overlap between the goals and approaches of the studies in each section to provide comparisons, this is not the case in Chapter 3.

3.3 Social network analysis and behaviour

In this section, studies applying SNA to understand behaviour are described. Although some of the studies (section 3.3.1) do cover what Stern (2000) calls ‘environmentally significant behaviour’ (e.g. Olli *et al.*, 2001; Jager, 2006) studies (section 3.3.2) here also focus on behaviours from other areas, such as smoking behaviour (Hall and Valente, 2007), substance use (Moody *et al.*, 2011) and obesity (Christakis and Fowler, 2007).

3.3.1 Social network analysis and environmentally significant behaviour

Social networks analysis has been used alongside environmentally significant behaviour (ESB) in a small number of studies, and was found to be “more important than any of the other correlates of environmental behaviour” (Olli *et al.*, 2001:201). The difficulties in using established social network techniques may have prevented what might be considered a typical social network

exploration to understand ESB, and instead alternative measures have been devised. For example, Jager (2006), seeking to understand the diffusion of solar photovoltaic panels, measured the effect of an individual's social network by simply counting how many people a focal individual knew that already had solar photovoltaic panels installed. A positive correlation was found, with those who knew more people with solar photovoltaics installed more likely to adopt the technology themselves. Although this helps to begin to understand the adoption of solar photovoltaic technology, the measure of social network influence is a less formal measure than what has been described in this chapter.

The same suggestion can be made for the remainder of the articles that investigate social networks and ESB. In a study of waste and energy behaviour in the home, using the Global Action Plans 'EcoTeams' approach (Nye and Burgess, 2008) social network influences were found to have a positive effect on changing behaviour. The measurement of social networks was again informal and non-typical, and focussed on participation in meetings where group members exchanged information and support.

In a further study of the Global Action Plan approach (Nye and Hargreaves, 2010), waste and energy consumption in the workplace were studied. In this study 'environmental champions' delivered information and support in meetings with their colleagues within their department. The measure of social networks was again informal and non-typical, this time focussing on time spent in contact with an environmental champion and participation in the programme, vs. non-participation. Nye and Hargreaves (2010) found the environmental champions approach to be successful, with contact time having a positive correlation with pro-environmental behaviour change.

Olli *et al.* (2001) measured 'intensity' of social networks by focussing on individuals' level of involvement and activity with environmentalists groups, such as Friends of the Earth, Norway; Greenpeace, Norway; and the Norwegian Society for Organic Farming. Participants were divided into three groups - control, low involvement and high involvement - based upon the time they spent

with the environmentalists groups, time spent volunteering, and social contact with environmentalist group members outside of formally organised activities.

Frequency of performance of 16 environmentally conscious behaviours was measured, alongside attitudinal factors using the NEP scale. Olli *et al.* (2001:201) reported that social networks were "more important than any of the other correlates of environmental behavior". They suggested that social networks were more important than the *sum* of all socio-demographic characteristics, and more important than attitudinal factors in determining frequency of performance of the 16 environmentally conscious behaviours.

It should again be noted that 'intensity' of social networks, as measured in Olli *et al.* (2001), is distinctly different from the standard measures of social networks as described in section 3.2.1. No reference is made in the article of studying ego or whole networks, both of which would have provided a more formal, in-depth and structured perspective on the effects of social network influences on environmental behaviours.

The four articles reviewed here have suggested that social networks are an important predictor of ESB. The techniques used to assess interpersonal influence though are non-typical, and therefore it remains to be seen as to whether a more formal, standard use of social network analysis and ESB will suggest such a strong relationship.

Including studies for review beyond the ESB research area may provide a greater understanding of the link between a more formal analysis of social networks and behaviour. The following section investigates formal studies of social networks that are used to understand other types of behaviours. These include, for example, obesity (Christakis and Fowler, 2007), substance use (Latkin *et al.,* 1995; Moody *et al.,* 2011) and smoking behaviour (Hall and Valente, 2007).

3.3.2 Social network analysis and non-environmentally significant behaviour

Moving away from ESB, social network analysis has been used in the health fields, where understanding and changing unhealthy behaviours is typically the focus of studies. Whereas in section 3.3.1, every study known that has used social network analysis along with ESB was included, in this section studies were only included that have used formal social network analysis techniques.

Christakis and Fowler (2007) studied a large connected social network to understand the contagion of obesity. Network data was collected over a period of 32 years, with the original 5,000 participants termed as egos, and any offspring or close friends that they named throughout the 32-year study period termed as alters. The original 5,000 participants were met seven times over the course of the study period. At each time point, their body-mass-index was measured, along with their ego network. During analysis, each individual's ego network was connected with other ego networks, at the intersection where individuals overlapped – i.e. if an ego in one network was also an alter in another, or where alters appeared in two networks, these networks would be connected.

Christakis and Fowler (2007) found that obesity spread person-to-person and through interpersonal induction, with clusters of obese and clusters of non-obese individuals found throughout their data. Christakis and Fowler (2007:377) suggested that "the psychosocial mechanisms of the spread of obesity may rely less on behavioural imitation than on a change in an ego's general perception of the social norms regarding the acceptability of obesity".

Jaccard *et al.* (2005) studied the influence of peers on adolescent sexual activity and binge drinking. An ego network analysis approach was chosen, with ego reporting on their five closest same-sex friends and reporting a number of characteristics of their relationship, such as frequency of contact and matters discussed when together. From this information, a single closest friend was established, leaving a pair of individuals (dyad). Data were gathered regarding each adolescent's attitudes, relationships with family and behaviours. Data

collected were at two time points, in order to understand changes over time. Although interpersonal influence was found, the magnitude of the influence was small for both sexual activity and binge drinking, with Jaccard *et al.* (2005:144) suggesting that “our data do not support the notion of pervasive peer influence on the part of one’s closest friend”.

Latkin *et al.* (1995) studied the patterns of drug use and HIV infection risk behaviour among urban drug users, focussing on the make up of an individual’s network to determine behaviour. An ego network analysis approach was taken, with ego’s reporting on members of their social network that they have known for more than a month, members of their social network that could provide them with assistance, and their perception of the relationships between those named in their social network (so called alter-alter ties). Network members were coded as to their relationship with ego, differentiating between partners, family, friends and work colleagues.

Latkin *et al.* (1995) found that the make up of the individual’s social network significantly affected injecting drug use. Latkin *et al.* (1995) found that individual’s in relationships less frequently injected themselves than those without partners, whereas the presence of kin in an individuals network had no effect on injecting behaviour. Latkin *et al.* (2007) posit that partners provided daily routine, emotional support and self-esteem to injecting drug users, and that this support affected their drug usage.

Moody *et al.* (2011) used social networks analysis techniques to study adolescent popularity over time (five years) proposing to link increasing and changing popularity with substance use. Moody *et al.* (2011) hypothesised that an individual’s position within a social network, as determined by popularity, will determine their level of substance use. A whole network approach was utilised by Moody *et al.* (2011) with an average of 87 per cent of a population of 16,000 participating. Participants named two best friends, and five other close friends from their school year. The behaviour studied was substance use, determined

by frequency of use of tobacco, alcohol and marijuana over the month prior to data collection.

Moody *et al.* (2011) found that in later school years, adolescents who were more popular than their peers were more likely to use tobacco, alcohol and marijuana. The analysis by Moody *et al.* (2011) suggested that changes in network position, swinging from being popular to not being popular (or vice-versa) correlated with increased substance use.

Rice *et al.* (2003) also studied adolescent substance use, focussing on alcohol, tobacco and marijuana use. Rice *et al.* (2003) approached understanding an individual's social network differently from Moody *et al.* (2011), measuring ego network analysis as opposed to whole network analysis. To collect ego network analysis data, each ego was asked to name three close friends from their school year; 99 per cent of targeted pupils responded. Individuals are included in the data analysis as an ego in their own network, and as an alter in their peers' networks. Data were collected over three years to provide a longitudinal analysis.

Rice *et al.* (2003) measured a number of additional characteristics of individuals. These included measures of sensation seeking, prior drug use, attitudes towards drug use, closeness towards family, susceptibility to peer pressure and drug use behaviour. Analysis of interpersonal influence compared an ego's responses to the drug use, attitudes towards drug use and sensation seeking items, with the same data collected from their alters. As with the Moody *et al.* (2011) study, use of all three substances increase over time, as the adolescents approach adulthood. Ego's substance use was significantly related to egos own sensation seeking and to their alters' substance use.

Hall and Valente (2007) studied peer selection and interpersonal influence in relation to adolescent smoking behaviour. A whole network approach was used, with students asked to nominate their five best friends in their class. Hall and Valente (2007) used a somewhat course measure of selection and influence - the number of nominations an individual receives from fellow students

measures influence, whereas the number of nominations a student makes measures selection (even though the study design limited each student to a maximum of five nominations). Data were collected over two time points 12 months apart to understand changes in behaviour over time.

Hall and Valente (2007) found that peers impact both current and future smoking behaviour. Students that didn't smoke at the first data collection, and whom selected smokers as friends at stage one, became smokers or increased their susceptibility to smoking by stage two. Being nominated by smokers at stage one was found to shape an individuals' social context at stage two, and found to predict smoking behaviour at stage two.

Hoffman *et al.* (2007) studied smoking behaviour, to understand peer selection and influence mechanisms. Hoffman *et al.* (2007) did not find that peer influence was at play; adolescents not smoking at the first data collection were still not smoking at the second data collection, despite having friends that smoked. Peer selection however was found; adolescents smoking at the first data collection were found to select smoking friends at the second data collection.

Gayen and Raeside (2007) investigated the link between experience of neonatal death and birth assistance in rural Bangladesh, seeking to establish whether the use of professional birth assistants reduced the likelihood of neonatal death. They found that women who are central in the village network were more likely to receive help from traditional birth assistants (as opposed to family assistants or professional birth assistants) and *less* likely to experience neonatal death. Gayen and Raeside (2007) suggested that although professional birth assistants were available, and free to use, social norms dictated that traditional birth assistance should be used where available, and that family members assist when traditional assistants are not available.

The use of traditional birth assistants was linked to a women's centrality in their village – the more central the women is in the village network, the more likely traditional assistants will be used. In contrast to the expected findings, Gayen

and Raeside (2007) found a strong link between neonatal death and the use of professional birth assistants. Neonatal death increased as the use of professional birth assistants increased. Gayen and Raeside (2007) posited that this link was due to the professional birth assistants only being used as a last resort, after problems had already occurred during birth - typically after family assistants, but also after traditional birth assistants had been used.

3.4 Social network analysis and attitudes

In addition to applying social network analysis to understand and explain behaviour, studies have sought to use social network analysis to understand differences in attitudes (or attitudinal factors), and explain the development or change in attitudes with regards to social context and interpersonal influence.

De Klepper *et al.* (2010) studied Dutch Naval College students, seeking to explain the formation of friendships, and differences in discipline amongst the students. De Klepper *et al.* (2010) studied the co-evolution of attitudes towards discipline, and friendship networks, over time, to find out whether selection or influence explained differences in attitudes towards discipline. De Klepper *et al.* (2010) found that, in contrast to informal settings where there is less constraint upon whom to befriend, and selection typically explains attitude similarity, in a military context, where selection is constrained, influence was the main cause in similarity among friends attitudes towards discipline. Over time, attitudes towards discipline within networks of Naval students converged.

Kilduff (1992) studied the choices of 170 MBA students, seeking to understand whether individuals' own personality traits, and their connections to social network members, influenced their preferences for interviews with prospective employers. Kilduff (1992) found that an individual often selected to have interviews with the same companies as their social networks members selected, and that this was especially true when a pair of friends both scored high on the one of the personality traits scales (self monitoring scale; Snyder and Gangestad, 1986), suggesting that the students are attuned to the role expectations of others.

Levitan and Visser (2009) studied the strength of individuals' attitudes in relation to the attitudes of individuals in their social network. Undergraduate students from the University of Chicago were asked about their attitudes towards affirmative action and the George Bush presidency, as an initial questionnaire pre-test. Students were asked to elicit the names of their five closest friends, and were given a counter attitudinal persuasive message (based upon their attitudes in the pre-test). After reading the persuasive message, students again answered questions about their attitudes towards affirmative action and the George Bush presidency. They also gave their perceptions of their friends' attitudes towards affirmative action and the George Bush presidency. Individuals appeared in the study both as an ego in their own network, and as an alter in others' networks.

Levitan and Visser (2009) found that an individuals' resistance to the persuasive message was related to their own strength of attitude and the composition of their network. While finding that those with stronger attitudes towards an issue are less resistant to counter attitudinal information is maybe unsurprising, the link with network composition is interesting. Levitan and Visser (2009) found that those individuals in 'attitudinally congruent' networks – i.e. where there is little variation in attitudes amongst network members and the focal individual, were more resistant to persuasion that those in 'attitudinally diverse' networks – where network members hold differing, competing views on issues.

In a similar study (Levitan and Visser, 2008), 335 randomly selected participants answered attitudinal items about capital punishment. A pre-test questionnaire was given to participants to understand their attitudes towards capital punishment for people convicted of murder. To understand network composition, participants elicited the names of their five closest friends, and also gave their perception of their friends' political views. Participants were exposed to strong and weak counter attitudinal persuasive messages in order to understand their resistance to persuasion.

As with the 2009 study, Levitan and Visser (2008) found that those in 'attitudinally congruent' networks were more resistant to the persuasive message than those in 'attitudinally diverse' networks. Individuals in 'attitudinally congruent' networks were not affected by the strong and weak counter attitudinal messages, suggesting that their attitude towards capital punishment was not a result of the message. Individuals in 'attitudinally diverse' networks were affected by strong rather than weak arguments. Levitan and Visser (2008:645) posited that individuals in 'attitudinally diverse' networks "thoughtfully examine attitude-relevant information, contemplating its implications for their attitudes rather than mindlessly accepting or rejecting the new information".

3.5 Social network analysis in organisations

In this section, the focus is on studies that have sought to understand social context alongside employee attitudes and/or behaviours. These attitudes and behaviours are not necessarily related to environmental concerns, or environmental problems. Many of the articles cited here explore employee perceptions of justice within their organisations.

Pastor *et al.* (2002) describe a 'network effects' hypothesis, suggesting that individuals in a social network will converge in their views and behaviours due to proximity and exposure to others in the network. They go on to suggest that what may start out as "unorganised and idiosyncratic" (Pastor *et al.,* 2002: 411) views ought to converge over time, and for this convergence to be correlated with the patterns of communication and influence within a department or team. Pastor *et al.* (2002) test for proximity and convergence in a university campus police department, the head of which was retiring after a long tenure. Pastor *et al.* (2002) wished to understand whether attributions of charismatic performance of the outgoing head were similar across the department. Two networks were described – a 'work task' network and a 'friendship' network.

Pastor *et al.* (2002) found support for their proximity and convergence effects hypotheses in their studies. Proximity predicted similarities in attributions of

charisma, with the friendship network found to be a better predictor of similarities in attributions of charisma than the task network. The same could be said of the convergence hypothesis; attributions of charisma at the first data collection were less similar than they were at the second, suggesting convergence effects. A caveat was found however, in that at the third data collection, attributions of charisma were less similar than at the second. Pastor *et al.* (2002) suggested that network effects can change over time, and do not necessarily become stronger.

Umphress *et al.* (2003) and Chia *et al.* (2006) sought to understand employee perceptions of justice in their workplace. Umphress *et al.* (2003) proposed and found that social ties influenced perceptions of justice, and that in situations where there was greater ambiguity, there was a greater possibility for social influence, as employees sought to make sense of situations. Chia *et al.* (2006) studied network ties and perceptions of justice in the workplace, but in relation to information seeking, volunteering and acceptance. Chia *et al.* (2006) found that social relations determined information flow – the closer the relationship between a pair of employees, the more likely that information will be sought, volunteered and accepted from within the pairing.

Both Umphress *et al.* (2003) and Chia *et al.* (2006) differentiated between network tie types in a different way to Pastor *et al.* (2002). Whereas Pastor *et al.* (2002) differentiated between friendship and task network ties, Chia *et al.* (2006) differentiated between 'expressive' (frequent, strong and intimate interaction) and 'instrumental' (infrequent, weak, arm's length interactions) network ties. In every case, Chia *et al.* (2006) found that expressive ties were better predictors of information flow than instrumental ties. Umphress *et al.* (2003) also found that expressive ties were better predictors of attitude similarity than instrumental ties, though this was found for only one of the three types of justice (no significant relationships were found for either expressive or instrumental ties, and the other two types of justice).

Zagenczyk *et al.* (2010) used workplace social ties to explain employee perceptions of support. Zagencyzk *et al.* (2010) did not differentiate between network ties using the Pastor *et al.* (2002) or the Chia *et al.* (2006) and Umphress *et al.* (2003) methods, instead studying both advice and friendship networks. Zagencyzk *et al.* (2010) hypothesised that in both advice and friendship networks, perceptions of organisational support would be affected directly by inquiry with co-workers, and indirectly through monitoring of employees in similar positions. Zagencyzk *et al.* (2010) found that the only hypothesis that they failed to find support for was that co-workers in friendship networks did not significantly affect each other's perceptions of organisational support. Support was found for co-worker influence in advice networks, and for similar perceptions of support that were based upon sharing similar positions in the advice and friendship networks (Zagencyzk *et al.,* 2010).

The findings of Zagencyzk *et al.* (2010) echo an earlier study by Zagencyzk *et al.* (2008) where again, similarity in employee willingness to go above and beyond the call of duty was significantly related to strong advice ties, but not strong or weak friendship ties. Although Zagencyzk *et al.* (2008) again suggested that this was unexpected; they go on to suggest that advice ties reinforce existing professional values, whereas friendship ties represent more stable relationships where information contrary to expected values may be shared.

In a study by Schulte *et al.* (2012), the perceived psychological safety of individuals in 69 teams was studied over a ten-month period. Schulte *et al.* (2012) sought to understand the co-evolution of peer selection and peer influence, in advice, friendship and difficulty networks. The study found that individual perceptions of team psychological safety grow to be more similar to individuals whom they share friendship and advice ties with, and dissimilar to individuals whom they share difficulty ties with.

3.6 Discussion

Twenty-two studies that have used social network analysis to inform the understanding of differences in individual behaviours and attitudes have been included in this chapter. Similarly to Chapter 2, where the 28 studies identified only provided a framework for the link between attitudinal factors and policy acceptability, the 22 studies included for review here indicate a relationship between social networks and behaviours and attitudes. The diversity in the methods used in the 22 studies reviewed in this chapter, the diversity in the characteristics of the samples, the diversity in the analysis techniques used, and the diversity in the behavioural focuses of the studies makes a detailed review, and comparisons across research articles difficult.

In section 3.3.1, only four studies had attempted to use social network analysis to seek to explain differences in environmentally significant behaviour, and none of the four had used what may be considered to be the textbook standard formal network analysis techniques. These four studies, at best, give an indication of the link between more general social contextual, interpersonal influences, and environmental behaviours. None of the four studies sought to understand policy acceptability.

Because of the lack of studies covering environmentally significant behaviours alongside social network analysis techniques, section 3.3.2 covered eight studies that used formal social network analysis techniques with other types of behaviour. Typically, these studies were from the health behaviours field, such as obesity (Christakis and Fowler, 2007), smoking behaviour (Hall and Valente, 2007), and substance use (Moody *et al.,* 2011), for example.

In these eight studies, social network factors were found, with varying degrees of confidence, to be able to contribute to the explanation of differences in behaviour. Christakis and Fowler (2007:377) concluded that “the psychosocial mechanisms of the spread of obesity may rely less on behavioural imitation than on a change in an ego’s general perception of the social norms regarding the acceptability of obesity”, with Hall and Valente (2007:3058) also concluding

that “results indicate that peers impact both immediate and future smoking behavior and influence the development of friendship networks”, with Moody *et al.* (2011:111) suggesting that “these results are consistent with a status-seeking model of substance use”.

In four studies where social network analysis was used to understand differences in attitudes, conclusions again suggested a positive link between social networks and attitudes. For example, De Klepper *et al.* (2010:88) concluded, “naval students became similar in (attitudes towards) discipline through their friendship relations”, and in Levitan and Visser (2009:1064) “far from being formed in isolation within the individual human mind, attitudes are fashioned and maintained within a rich and elaborate social context”.

3.6.1 Implications for this study

The majority of the 22 studies included in this chapter suggest the importance of social networks in the understanding of both attitudes and behaviours, both in the workplace, and outside. This thesis will seek to extend the evidence for this relationship, and make a more robust investigation of environmentally significant behaviour and social networks, by using established formal techniques.

Objectives 3 and 4 are developed to understand the relationships between attitudes and social networks, and behaviours and social networks:

> *To explore the relationship between attitudinal factors and social networks*
>
> *To explore the relationship between acceptability of policies and social networks*

Because of the size of the staff population, and therefore the unlikeliness of achieving data collection from every employee in a whole network design, ego network analysis will be used in this study. The study by Rice *et al.* (2003) found that ego’s were poor at reporting accurately on the behaviours of their network

members. This study will attempt to avoid this issue by asking both ego's and alter's to provide self reports on both their attitudes and acceptability of policy.

Objective two has been developed to understand the social networks at a higher education institution:

To explore employee social networks within a higher education institution

3.7 Chapter summary

In this chapter, a number of studies have been reviewed that have used social network analysis to improve understanding of differences in attitudes and behaviours. Studies focussed on environmentally significant behaviours, attitudes, health behaviours and social networks in organisations. The evidence base is broad and diverse, and the quantity of very relevant studies is low. However, the conclusions from many of the 22 studies are that social network factors are important determinants of behaviours and attitudes.

The following chapter details the methodology that is used in this thesis to collect a robust data set containing both the attitudinal factors influencing policy acceptability, and also allows for a full scoping of social network factors.

3.8 Research hypotheses

Across the two literature review chapters, five research objectives have been developed. These are restated here along with a hypothesis for four objectives:

Objective 1: To understand attitudinal factors influencing acceptability of greenhouse gas emissions reduction policies, using the value-belief-norm theory

Hypothesis: Individuals with pro-environmental attitudinal perspectives will be more likely to accept policies to reduce greenhouse gas emissions

Objective 2: To explore employee social networks within a higher education institution

Hypothesis: There is no hypothesis concerning the social networks at a higher education institution

Objective 3: To explore the relationship between attitudinal factors and social networks

Hypothesis: Attitudinal factors towards the environment will be similar amongst those who are connected in networks

Objective 4: To explore the relationship between acceptability of policies and social networks

Hypothesis: Individuals who are connected in networks will have similar acceptability of policies to reduce greenhouse gas emissions

Objective 5: To test the full value-belief-norm theory

Hypothesis: The expectation is that variables in the theory are significantly predicted by preceding variables in the theory, and less so by variables 'further back' in the theory. The VBN theory will also be tested for mediation, with the expectation that a variable sufficiently mediates the relationship between variables immediately preceding and following it

Chapter 4 Methodology

4.1 Introduction

In this chapter, the methodology that was used to collect data for this study is described. The chapter begins with a detailing of the development of the questionnaire that was used to collect data (section 4.2). The questionnaire contained 46 items and follows the full use of the Stern *et al.* (1999) and Stern (2000) value-belief-norm (VBN) theory. Seven policy proposals regarding the University's greenhouse gas emissions were included in the questionnaire. Section 4.2 describes the questionnaire layout (section 4.2.1) and informed consent (section 4.2.2) information, as well as the development of the 46 items, seven policy proposals and socio-demographic items (sections 4.2.3 to 4.2.7).

Following a description of the method used to develop the questionnaire is a description of the method used to recruit participants for the study (section 4.3), and a 'walk-through' of the data collection appointment, between the researcher and the participants (section 4.4), where the social networks tasks were completed along with the questionnaire. Section 4.5 details the recording of the data into spreadsheets. Section 0 details pre-testing of the data collection exercises.

The chapter closes with an exploration of the alternative approaches that could have been adopted in this study (section 4.7), alongside a statement of the epistemological and ontological position of the research (section 4.8). Before the commencement of the data collection exercises, the DMU Faculty of Technology Research Ethics Committee approved the process that is described in this chapter.

4.2 Questionnaire development

In Chapter 2, it was identified that the VBN theory (or some of the constructs that make up the theory) have frequently been used to understand attitudinal

factors affecting policy acceptability, and it was selected for use in the present study. To re-iterate, the theory brings together altruistic, biospheric and egoistic values from the Schwartz values scale (Schwartz, 1992, 1994), worldviews using the NEP (Dunlap and Van Liere, 1978; Dunlap *et al.*, 2000) and awareness of consequences (AC), ascription of responsibility (AR) and personal norms (PN) following the norm-activation theory (NAT) (Schwartz, 1977). A schematic of the theory is shown in Figure 3.

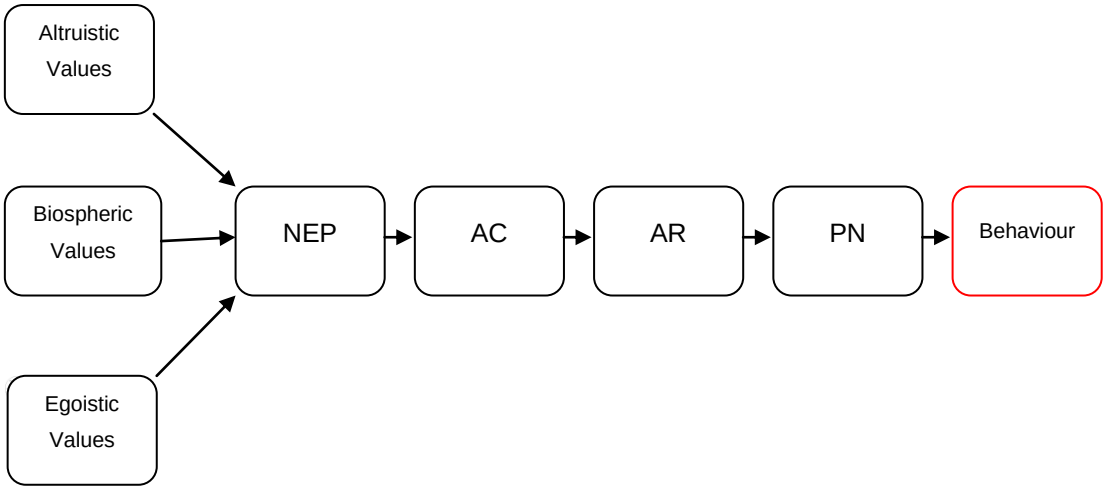

Figure 3: A schematic of the value-belief-norm (VBN) theory (*cf.* Stern, 2000)

4.2.1 Questionnaire layout

In this study, the full VBN theory, as proposed by Stern *et al.* (1999) and Stern (2000) is used, using all seven latent attitudinal constructs as shown in Figure 3, to understand policy acceptability ('behaviour' in Figure 3). A questionnaire with two main sections was used to collect VBN theory data and acceptability of policy proposals. The seven latent constructs from the VBN theory were covered in the first section of the questionnaire, and included 46 items. The second main section of the questionnaire contained seven policy proposals for which participants were asked for their acceptability judgements towards. The final page of the questionnaire contained seven items collecting socio-demographic information. The questionnaire was printed over nine A4 (210mm x 297mm) pages, single sided, in landscape orientation (see Appendix 1).

The 46 items in the first section of the questionnaire were divided into three sub-sections, each shown on a separate A4 (210mm x 297mm) page. The first page of the questionnaire contained informed consent information (see section 4.2.2). Page two covered the Schwartz values scale (13 items - page two) (see section 4.2.3), page three the NEP (15 items) (section 4.2.4) and page five the NAT (18 items) (section 4.2.5). Page four described what is meant by the terms 'greenhouse gas emissions' and 'global climate change', as they are frequently used in the NAT section on page five. The second section of the questionnaire (pages six to eight) contained the policy proposals that form the dependent variables for this study (section 4.2.6). Each policy proposal was provided with a short statement of contextual information.

4.2.2 Informed consent

The first page of the questionnaire contained some information for the participant, describing to them what to expect in the questionnaire. For an 'ego' – the participant that was met face-to-face by the researcher – this information was brief, and only contained an introduction to the sections in the questionnaire, a note about right and wrong answers and a prompt to ensure that the participant knew that they could ask the researcher questions at any time, if they so wished. For an 'alter', a participant that received the questionnaire from an ego (i.e. not from the researcher), this brief introduction was supplemented with some additional information about the research project and sponsors, and the reasons why the alter had received the questionnaire (see Appendix 2). Further detail about the difference between egos and alters, and the data collection processes is included in section 4.4.

The supplementary information provided in the questionnaire to alters was also provided to egos in the email that they received, inviting them to participate in the study. More detail about the email invitation and the information provided at the data collection appointment are provided in section 4.3 and section 4.4 respectively.

4.2.3 Values

Values are the first three constructs in the VBN theory, from left to right in Figure 3. Items used to measure values were drawn from Schwartz's 56 values scale (1992, 1994). A set of 13 values items is used in this study to measure the three latent values orientations. The 13 values items in this study are proposed to measure altruistic (four items), biospheric (four items) and egoistic (five items) value orientations, in line with the recommendations made in De Groot and Steg (2007), and build upon the 12 values used by Steg *et al.* (2005) in their testing of the VBN theory. The response scale used in this study is that proposed by Schwartz (1992, 1994) in the development of the values instrument. The scale ranges from -1 (*opposed to an individual's values*) through 0 (*not important*), to 7 (*of supreme importance*). The 13 items were asked in a random order, in line with previous studies (Stern *et al.,* 1999; Steg *et al.,* 2005; De Groot and Steg, 2007).

4.2.4 New environmental paradigm (NEP)

The next construct in the VBN theory is worldview, measured by the NEP (Dunlap and Van Liere, 1978; Dunlap *et al.*, 2000). The updated version of the NEP (Dunlap and Van Liere, 1978; Dunlap *et al.*, 2000) had not been published in 1999 when the VBN theory was published by Stern *et al.,* but had been proposed and presented at a conference by Dunlap and colleagues in 1992, and was used by Stern *et al.* (1999). In the VBN theory, Stern *et al.* (1999) used a subset of five of the 15 statements that are included in the full NEP.

The NEP has been widely used since its introduction, with previous factor and reliability analyses identifying between one and four underlying dimensions (Hawcroft and Milfont, 2010). The five NEP statements that Stern *et al.* (1999) used do not represent the dimensions that more than 10 years of testing have now identified. As such, and following Steg *et al.* (2005), the full 15 statement NEP scale was used in this study.

To rate the 15 NEP statements, participants used a five point Likert scale, from 'strongly disagree' to 'strongly agree', centred on 'unsure', as recommended by Dunlap and Van Liere (1978) and Dunlap *et al.* (2000). The 15 statements were asked in the order as proposed by Dunlap *et al.* (2000), whereby a positively worded statement would be followed by a negatively worded statement. Agreement with a positively worded statement and disagreement with a negatively worded statement, both equated to a pro-environmental worldview. In the data input and analysis, recording of negatively worded statements was reverse coded to reflect this.

4.2.5 Norm-activation theory (NAT)

The final three latent constructs in the VBN theory replicated the norm-activation theory (NAT) as proposed by Schwartz (1977). The three constructs - awareness of consequences (AC), ascription of responsibility (AR) and personal norms (PN) - differ from the values and worldview constructs used in the VBN theory as they do not have a prescribed set of items which can be re-used. Instead, Schwartz (1977), Stern *et al.* (1999) and Steg *et al.* (2005) recommended that items used in the NAT constructs were tailored towards the behaviour that is being studied. In this study, a new set of 18 items were developed and used to measure AC, AR and PN.

As a starting point for developing the 18 items, the 21 items used by Steg *et al.* (2005) in their testing of the VBN theory were used. The 21 items used by Steg *et al.* (2005) were reduced to 18 so that an equal amount of items were asked for each construct, (Steg *et al.* use six for AC, six for AR and nine for PN) and adapted to more closely align with the behaviour that is the focus of this study. Table 6 shows an example item for each of the three constructs from the Steg *et al.* (2005) study and the altered version used in this study.

Table 6: Development of items from the norm-activation theory

Construct	Steg *et al.* (2005)	The present study
AC	Energy savings help to reduce global warming	Reducing greenhouse gas emissions helps to reduce the effects of global climate change
AR	I feel jointly responsible for the exhaustion of energy resources	I feel jointly responsible for worldwide greenhouse gas emissions
PN	People like me should do everything they can to reduce energy use	People like me should do everything they can to reduce their greenhouse gas emissions

On the page preceding the 18 NAT items a short paragraph explaining what was intended by the terms ‘global climate change’ and ‘greenhouse gas emissions’ was provided to the participants to help them to understand the 18 NAT items, 16 of which contained one of the two terms. This paragraph of text is shown in Appendix 1, on page four of the questionnaire.

A five-point Likert scale, from ‘strongly disagree’ to ‘strongly agree’, centred on ‘neither agree, nor disagree’ was provided, with an additional sixth response option ‘don’t know’. It was felt, by the researcher, that the response scale used for the NEP did not provide participants with enough options, and so ‘unsure’ was dropped in favour of ‘neither agree, nor disagree’ and ‘don’t know’ was added. The 18 items were asked in a random order, as recommended in Steg *et al.* (2005).

4.2.6 Policy proposals

Seven policy proposals were developed for use in this study. Participants were asked to what extent they accepted the policy proposals. The seven policy proposals are listed in Table 7. One of the seven proposals asked about DMU

reducing greenhouse gas emissions, and another asked about receiving less funding if they did not. The remaining five policy proposals were developed in conjunction with DMU practitioners who have responsibilities for sustainability, energy and travel, at the university. The five policies related to hypothetical initiatives that DMU could introduce in order to reduce its greenhouse gas emissions. One of the five proposals asked participants to balance environmental concerns with financial concerns (proposal three in Table 7). Two of the remaining four were considered to be 'pull' measures – measures that were anticipated would be well received by employees as they incentivised desirable behaviour (proposals four and seven); the remaining two were considered to be 'push' measures – proposals that would not be perceived positively by employees as they punished undesirable behaviour (proposals five and six).

Each policy proposal was prefaced with a short sentence of contextual information. For example, policy proposal number three focused on international student recruitment; the number of current international students and approximate percentage of DMU emissions associated with international student travel was provided in the questionnaire, before the participant was asked for their acceptability of the policy proposal.

Table 7: The seven policy proposals used in the study

Proposal	Statement
1	De Montfort University should reduce its greenhouse gas emissions
2	If De Montfort University does not reduce its greenhouse gas emissions it should receive less funding from central government
3	De Montfort University should reduce future enrolments of attending international students by 20%
4	Where possible, De Montfort University should allow staff the option to work from home one day per week
5	De Montfort University should gradually increase the price of a parking permit so that in five years it is double what it is now (£240)
6	De Montfort University should lower the target temperature that offices, classrooms and lecture halls will be heated to during working hours in the winter months to 20°C
7	De Montfort University should pay for annual train travel tickets for staff, and collect the money back through monthly wage contributions, interest free.

A five-point Likert scale, from ‘very unacceptable’ to ‘very acceptable’, centred on ‘neither acceptable, nor unacceptable’ with an additional sixth option ‘don’t know’ was used for the seven policy proposals, in line with the scale used to respond to the items in the NAT section of the questionnaire.

4.2.7 Socio-demographic items

An additional seven items were asked seeking to understand the socio-demographic characteristics of the participants. The items asked for age, gender, job type, employment status, time employed by DMU, qualifications and earnings. The response categories are shown in Table 8.

Table 8: Response categories for the seven socio-demographic items

Age	Gender	Job Role	Status	Time at DMU	Education	Income
16-24	Male	Academic - Teaching	Full-time	< 1yr	GCSE	< £10,000
25-34	Female	Academic - Research	Part-time	1-3yrs	A-Level	£10-£20,000
35-44		Support - Admin		3-5yrs	UG Degree	£20-£30,000
45-54		Support - Teaching		5-10yrs	PG Degree	£30-£40,000
55-64		Support - Other		> 10yrs	Doctoral	£40-£50,000
65+						£50-£60,000
						> £60,000

4.3 Participants and recruitment

In this section, the recruitment of participants is explained. The recruitment of participants took place between Monday 25th January 2010 and Wednesday 31st March 2010. Participants in the study were employees of De Montfort University (DMU).

Employees were randomly selected to take part in the study, and invited by email. To invite participants, the directory of employee email addresses was downloaded and sorted alphabetically in Microsoft Excel. This directory originally contained 3,449 entries. This was manually reduced by the researcher to 2,322 entries, once duplicates and non-personal email addresses were removed (removal of admin@dmu.ac.uk or careers@dmu.ac.uk, for example). In Microsoft Excel, the remaining 2,322 employee email addresses were

assigned a random number and sorted by this random number, from largest to smallest. Employees were invited from the top of the list, working down.

In the first week of the study, commencing Monday 25th January 2010, 10 invitations were sent out, before 10am. After the first week, the number of invitations was increased to 30 per week, always sent on a Monday morning before 10am. In the first week, the number of invitations sent was kept low purposely, as the level of interest in participation was unknown by the researcher. It was considered important that the researcher should be able to respond promptly to email replies from potential participants, and also to be able to make an appointment with participants at the time that they requested, and preferably within five working days. Sending a greater number of invitations without knowledge of the interest in participation would have jeopardised these goals.

Invitees who did not respond to the initial invitation were sent a reminder email seven days later. Table 9, columns two and three details the full schedule for invites and reminders. Individuals invited in week one were labelled ‘group one’; invited in week two were labelled ‘group two’ and so on for the eight weeks that new invitations were sent out. If invitees did not respond to the initial invitation or reminder, they were marked accordingly on the spreadsheet and not contacted again. A copy of the email invitation and reminder email can be found in Appendix 3 and Appendix 4.

A total of 220 email invitations were sent between 25th January 2010 and 31st March 2010; 88 agreed to take part (40 per cent). Of the 88, 60 agreed to participate without the need for a reminder (68.2 per cent), with the remaining 28 participants requiring a reminder email. After eight weeks of sending new invitations the process was stopped, as it was felt that enough participants had been recruited to allow for robust statistical data analysis of the kind that is presented in Chapter 5.

4.4 Data collection appointment

DMU employees whom received the invite and wished to take part in the research made an appointment at a suitable date, time and place to meet the researcher. Most employees met the researcher in their own office. A few met the researcher at one of the coffee shops on campus. None were met at the researcher's office.

At the appointment, the researcher introduced the participant to two data collection tasks by reading three short paragraphs of information. The first section introduced the researcher to the participant, detailed the purpose of the data collection exercise, and briefly noted the sponsors of the research. The second section detailed the formalities – that all data collected will be treated with the strictest of confidence, that the participant is free to leave at any stage without explanation and that the participant can ask any questions they wish throughout the appointment. The final section described, briefly, the two data collection tasks, that there are no right or wrong answers, and the estimated time required to complete the appointment. Appendix 5 shows the full script. The two main tasks required at the appointment are described in sections 4.4.1 and 4.4.2.

4.4.1 Task One: Social network data gathering

The first task that the participant completed was a 'name generator' task, designed to elicit their 'ego-network'. A name generator task asks the participant (ego) to name individuals (alters) who meet a certain relationship criteria (a 'tie') set by the researcher. For this task there were two parts.

Ego-network analysis was chosen instead of whole network analysis, due to the size of the staff population at DMU (~2,700 employees). In ego-network analysis, individuals are asked about their own personal 'small world' networks. They report only on their own network, from their own perspective. The ego network task is divided into two parts, described in sections 4.4.1.1 and 4.4.1.2.

4.4.1.1 Part one - Ego-network data collection tasks

The relationship tie that ego was asked is a variant on that used by Burt (1984) in the US General Social Survey. The item required ego to name alters from within the University to whom they felt they were ‘very close’. To help egos to decide which colleagues met the ‘very close’ criteria, three additional prompts were included. These identified ‘very close’ alters as those who:

- Ego regularly kept in touch with
- Ego discussed important matters with
- Were there for ego when ego needed help

Wasserman and Faust (1994) suggest that there are methodological issues to be considered when responding to a name generator task. A variety of methods exist with which to manage the process of participants eliciting the names of their alters. These methods guide how the participant answers the ‘very close’ criteria, and how the responses will be interpreted and analysed. The first of the three methods governs whether the ego is allowed to consult a ‘roster’ to elicit names, or whether they ‘freely’ recall names without a prompt. The second governs whether ego names a pre-specified number of colleagues, or names as many as they feel meet the ‘very close’ criteria. The third governs whether those that are named are rated or ranked in any way. The methods chosen in this research are detailed here.

In this study, egos were not allowed to consult any resources to help them to remember alters’ names. It was felt that, if the relationship was truly ‘very close’, ego should know the names of their alters without a prompt. The alternative method would be to provide a register of all employees (~2,700) from which the participant could look through and name ‘very close’ colleagues. This would have been a particularly time consuming task and cumbersome task, for both the participant and the researcher.

Egos were allowed to name as many alters as they felt met the ‘very close’ criteria. There was no prescribed minimum or maximum. This method was

chosen to generate what was perceived to be the most accurate picture of the networks in the University. For example, specifying that egos name three or five or ten ‘very close’ alters would have forced a false arbitrary rule on them. It was not considered meaningful or representative of reality to force egos to choose a pre-specified number of alters. Some may not have had sufficient alters to meet the criteria and others may have had too many, forcing them into a choice.

Egos were not required to rate or rank those whom they named. Rating or ranking would have provided extra information about the strength of relationships. However, it becomes a difficult task for ego to accurately rate or rank the difference between alters when they name more than a few (Wasserman and Faust, 1994). In the present research, in one of the networks in the study, an ego named 26 alters; in this instance, using rating or ranking would have required the ego to choose between their relationship with their 25th and 26th alter, for example.

To ensure that every ego received the same information, the instructions for this part of the networks task were presented to ego printed on an A4 (210mm x 297mm) sheet, (see Appendix 6). To report on the names of the alters that met the ‘very close’ criteria, egos were asked to write the names of alters onto post-it notes. The post-it notes were then attached by ego onto a blank sheet of A3 (297mm x 420mm) paper. No significance was attached to whereabouts on the A3 (297mm x 420mm) paper the post-it notes were placed.

4.4.1.2 Part two - Relationships between alters

Once ego had named alters who met the ‘very close’ criteria, egos moved onto part two of the networks task. For this part of the task, they evaluated the relationships between the alters who they had named in part one of the task. The relationships between alters are referred to as ‘alter-alter’ ties.

If ego evaluated the relationship between two alters as being ‘very close’, using the same three criteria as they used in part one of the task, they drew a line onto the A3 (297mm x 420mm) sheet connecting the post-it notes of the two

alters that were perceived as being ‘very close’ to each other. An example of ‘alter-alter’ ties is shown below in Figure 4. The picture shows an actual ego network from the data collection appointment. The pink post-it notes each have one alters full name written on them (blanked out for ethical reasons). The lines connecting the pink post-it notes denote that the individuals who are named on the post-it notes are ‘very close’ to each other. Once ego had elicited all of the alter-alter ties, the social networks tasks were completed.

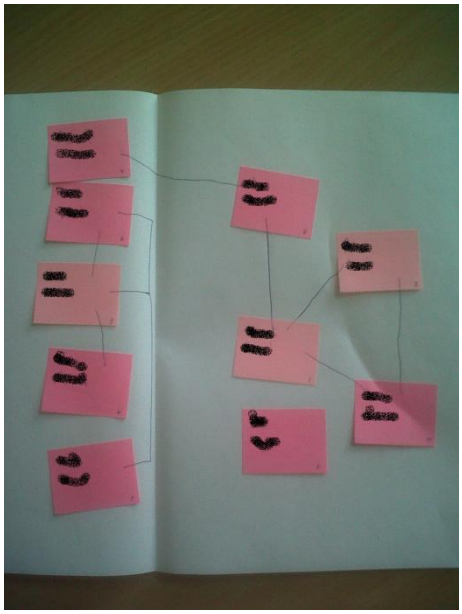

Figure 4: An example of alter-alter ties in an ego network

4.4.2 Task two: Questionnaire completion and distribution

After ego had completed the two social networks tasks, they moved onto answering the questionnaire that was described in section 4.2. The participant was handed a paper copy of the nine-page questionnaire and a pen, and asked to complete it during the appointment. All of the information required to complete the questionnaire was contained within the nine-pages of the questionnaire, and so the researcher was not required to explain or describe anything.

Whilst ego was completing the questionnaire, the researcher prepared copies of the questionnaire to be given to the alters whom ego had named in task one

(section 4.4.1). To prepare the questionnaires for alters, a number of tasks were carried out. For the analysis that followed the data collection, it was essential for the researcher to know which alter had completed and returned their copy of the questionnaire. The remainder of this section details the methods used to ensure that completed questionnaires could be attributed to the correct alters, in the correct networks.

Firstly, the names of alters were copied from the post it notes attached to the A3 (297mm x 420mm) sheet and into a register. In the register was recorded each alters full name against a list of sequential numbers, from 001 to 999, providing every alter with a unique ID. Questionnaires for alters were pre-printed by the DMU print department, with an ID number from 001 to 999 shown in the top right-hand corner of the first page of the questionnaire.

To ensure that alters received a questionnaire with an ID number that matched their number on the register, they were placed inside A5 (148.5mm x 210mm) envelopes, and the researcher wrote the first name of the alter on the front of the envelope. At the end of the data collection appointment between the researcher and the participant (ego), ego was handed one A5 (148.5mm x 210mm) envelope containing a numbered questionnaire for each of the alters they named in the ego networks task. Ego was asked to hand the questionnaires to the alters as per the name written on the front of the envelope. Egos were asked to hand the questionnaires in person to alters, but were also advised that putting questionnaires on an alters desk, in alters' pigeonholes (or similar) would also be acceptable. Envelopes were left unsealed.

Writing the first name of the alter onto the front of the envelope meant that ego knew which copy of the questionnaire to give to each of their alters. The unique ID printed on the first page of the questionnaire meant that the researcher knew which alter had completed the questionnaire, once it was returned. The unsealed A5 (148.5mm x 210mm) envelope was also labelled with the internal mail address of the researcher. The information page at the front of the

questionnaire asked alters to seal and return the questionnaire in the A5 (148.5mm x 210mm) envelope provided, in the internal university mail system.

4.4.3 Requesting questionnaire responses from alters

On the Monday morning three weeks after each ego was invited to participate in the research, alters who had not returned their paper copy of the questionnaire were contacted to ask them to respond. If an ego was met within a week of being invited to participate (typically they were), this allowed an alter at least two full weeks to fill in and return the questionnaire. A second email reminder was sent to non-responding alters another two weeks after the first email reminder, and a final third email reminder was sent another two weeks after that. A full schedule of the sending of reminder emails in shown in columns four to six of Table 9. The table also includes details of the invitations to egos. A copy of the email sent to non-responding alters is included in Appendix 7. The same email was sent on all three occasions.

In a handful of cases, non-responding alters had either lost, mis-placed or not received their copy of the survey. In these instances, they were re-sent a copy of the survey through the internal mail. The re-sent survey was identical to the one they would have received initially from an ego, and came with a self-addressed envelope to be returned through the internal mail system to the researcher. For these questionnaires, the alter ID number (from 001-999) was handwritten on the top right hand corner of the front page of the questionnaire, as the pre-printed version had already been handed out.

Table 9: Full schedule for ego and alter invites and reminders

Group	Initial Ego Invite	Reminder Ego Invite	1st Alter Chase	2nd Alter Chase	3rd Alter Chase	Online Questionnaire
1	25-Jan	01-Feb	15-Feb	01-Mar	15-Mar	29-Mar
2	01-Feb	08-Feb	22-Feb	08-Mar	22-Mar	05-Apr
3	08-Feb	15-Feb	01-Mar	15-Mar	29-Mar	12-Apr
4	15-Feb	22-Feb	08-Mar	22-Mar	05-Apr	19-Apr
5	22-Feb	01-Mar	15-Mar	29-Mar	12-Apr	26-Apr
6	01-Mar	08-Mar	22-Mar	05-Apr	19-Apr	03-May
7	08-Mar	15-Mar	29-Mar	12-Apr	26-Apr	10-May
8	15-Mar	22-Mar	05-Apr	19-Apr	03-May	17-May

4.4.4 Online questionnaire

To increase the response rate, an online version of the survey was produced using Survey Monkey. The online version of the survey included exactly the same written introduction, items and response methods as the paper version (though the line asking for the paper copy to be returned in the internal mail was, obviously, removed). The online version of the questionnaire was sent out to each non-responding alter two weeks after they received the third and final email reminder with reference to the paper copy of the questionnaire (column seven in Table 9).

Survey Monkey allows for a unique ID to be added to a web link URL. For each non-responding alter, a personalised URL was sent with their unique ID number from the register. The responses that were collected through the online version of the questionnaire were listed in Survey Monkey alongside each unique ID.

4.5 Data entry

Data collected at the appointment were entered into the researchers computer immediately after the appointment took place. The social network data, recorded on the post-it notes and A3 (297mm x 420mm) paper, was entered into a matrix using Microsoft Excel, Table 10 provides an example network. A ‘1’ placed in a cell denotes that two individuals are connected to each other. A blank cell denotes that they are not. Ego is connected to everybody else in the

network; alter-alter ties are present if they are perceived to exist by ego. Relationships are entered twice. In Table 10, the cell one across and two down is populated with a ‘1’ (in bold font) because individual one is connected to individual two. To reciprocate, the cell two across and one down is also populated with a ‘1’ (also in bold font) to indicate that individual two is connected to individual one. The data is therefore mirrored on the diagonal. The matrix captures all of the data collected from the social networks tasks.

Table 10: Data entry matrices for social network data

ID	1	2	3	4	5	6	7	EGO
1		**1**						1
2	**1**		1	1				1
3		1		1				1
4		1	1			1		1
5						1	1	1
6				1	1		1	1
7					1	1		1
EGO	1	1	1	1	1	1	1	

This method of entering social network data into Microsoft Excel was chosen as it can be easily transferred into UCINET, a programme used for the analysis of social networks. From UCINET, it is possible to export networks in a number of formats and therefore useable by a number of other programmes.

For the questionnaire data, responses were also entered into a Microsoft Excel spreadsheet. In the leftmost two columns the name and ID number of the individual was entered. This preceded 60 columns numbered sequentially from one to 60 to represent the 60 items in the questionnaire. An individual’s answer to each item was then entered into the corresponding cell according to name/ID and item number. Initially, item responses were recorded with a number according to the response option as read from left-to-right. For example, for a five-point Likert scale item, (from ‘strongly disagree’ to ‘strongly agree’, centred on ‘unsure’), ‘strongly disagree’ was coded as one, ‘unsure’ as three, and ‘strongly agree’ as five.

Most of the 60 items in the questionnaire were worded so that agreement would indicate a pro-environmental attitudinal perspectives and acceptability of policy. For some items in the questionnaire however, items were worded negatively, such that disagreement would indicate pro-environmental attitudinal perspectives. Once the data collection and entry tasks were completed, responses to negatively worded items were reverse coded. Where participants did not answer an item, or entered ‘don’t know’, the cell for the corresponding item was left blank to denote a missing response.

4.5.1 Data analysis

The analysis of the data collected with the questionnaire followed the methods identified in previous studies where the VBN theory was used to understand policy acceptability (Steg *et al*., 2005). A range of typically used techniques, such as factor analysis, reliability analysis, regression analysis and mediation analysis are used in Chapter 5 to assess the questionnaire data. In Chapter 6, this data is analysed alongside the social networks data to understand similarities in attitudinal factors and behaviours. The techniques used in Chapter 6 do not follow a protocol, as this is the first known analysis of this type of data.

It is recognised that structural-equation-modelling (SEM) is an alternative technique with which the questionnaire data could have been analysed. Although, SEM can offer a robust analysis of this type of data, it provides results that are not directly comparable with those presented in Steg *et al* (2005), where the full VBN theory was used, (as it is in this thesis), and many of the studies identified in Chapter 2.

4.6 Pre-testing

The questionnaire that was described in section 4.2 and the appointment process described in section 4.4 were pre-tested in December 2009 and January 2010, before commencement of the actual data collection. Three approaches were taken for the pre-testing that included a total of 20 participants.

For the first approach, the researcher took the required materials for the questionnaire and the social networks exercise to several departments around the campus at the study site. The researcher asked at the reception of several departments whether there was anybody available to go through the required tasks and provide feedback to the researcher. A total of eight participants were included in the first approach for pre-testing.

The second approach involved questionnaires being completed by fellow social scientists from the Institute within which the researcher was based, at a monthly meeting. The social networks exercise was not tested on this occasion, as the completion of the task would have required participants to name ‘very close’ colleagues whilst seated next to each other. It was felt that this task was not suitable for such a social setting. A total of seven participants completed this pre-testing exercise.

The final pre-test exercise involved friends of the researcher completing both the questionnaire and the social networks exercise. None of these participants worked at a university, but were asked to envisage participating as if they were in their respective workplaces. A total of five participants were included in this approach.

The three approaches to pre-testing delivered a number of developments to the questionnaire and the social networks task. Throughout the pre-testing, the language that was used in the questionnaire and social networks tasks was frequently remarked upon as being technical and confusing. Where possible, these terms were removed and replaced with terms that are more frequently used i.e. the social networks task originally required the participant to name ‘alters’, which is the correct, but technical term. This was removed and replaced with ‘work colleagues’.

The pre-test version of the questionnaire contained additional information about the HEFCE funding initiative to link capital spending to progress in reducing university greenhouse gas emissions, on page one. This information was remarked upon as being unnecessary and was removed. The description of the

terms ‘global climate change’ and ‘greenhouse gas emissions’, included on the pages before the 18 NAT items was moved from the first page of the questionnaire to page four.

In the pre-testing version of the questionnaire, the 13 values statements on page two originally did not have parentheses around the short description of the value. Values were originally presented in the questionnaire, for example, as ‘Equality – equal opportunity for all’. This was altered so that the dash was removed and the description was included in parentheses – i.e. ‘Equality (equal opportunity for all)’. This helped to clarify the statements.

One of the original statements intended to measure ascription of responsibility, read “my personal contribution to the global climate change is negligible”. This was changed to “because my personal contribution is very small, I do not feel responsible for global climate change”. It was pointed out that participants would possibly not respond with reference to their own feelings of responsibility, but their perspective on the size of their contribution to global climate change. The word ‘attending’ was added to the dependent variable regarding international student recruitment.

A number of additional policy proposals were also included in the pre-testing questionnaire. Some of these were removed as they were either considered to be too technical (e.g. setting of departmental carbon budgets) were already in place (e.g. double sided printing by default), or were irrelevant for the majority of employees at the study site (e.g. replacing university owned vehicles with fuel efficient vehicles).

4.7 Research approach

It is acknowledged that a number of alternative methods could have been identified and chosen to understand the attitudinal and social contextual factors that affect policy acceptability, beyond those chosen for use in this study. This study has used solely quantitative methods, and has not captured any qualitative data. The reasons for this approach are described here.

By taking a quantitative approach, a greater proportion of the employees of De Montfort University have been included in the study. A quantitative approach allows for the generalisation of the results beyond the study participants to the remainder of the employees at DMU, and to other universities. Over 400 employees (see section 5.2 for a full breakdown of participants) were included in this study, ~ 1 in 7 of the total population of employees at DMU. A quantitative approach was chosen as it aligns with all of the 28 studies identified in Chapter 2. Taking such an approach allows for comparison of the findings from this study, with the findings from the 28 studies described in Chapter 2.

A qualitative approach to understanding policy acceptability is possible – indeed it would have provided greater detail and a deeper understanding of the individuals' social network and attitudinal factors affecting their policy acceptability. However, a qualitative approach would have seen far fewer employees included in the study and restricted the ability to generalise beyond the study participants. It would have also have provided data that would not have been directly comparable with previous studies in the area. Additionally, time and resources restricted the possibility of a qualitative approach.

Such an approach to understanding social networks may also have restricted the data collection exercise where the questionnaire was handed out by ego to their alters. Without this method for data collection, it is likely that the number of participants that were included in the study would have been far fewer. In social network analysis, methods are, on the whole, quantitative, with no examples of qualitative methods in three handbooks of social network analysis methods (Wasserman and Faust, 1994; Carrington *et al.,* 2005; Scott, 2000), and only forming one short chapter in the most recently published handbook (Scott and Carrington, 2011).

For the social networks tasks, ego-network analysis was selected for use. The alternative methodology for consideration in social network analysis is studies of 'whole' networks. In whole network studies, it is important that every member of the population is accessed and that they complete the data collection tasks set.

In this study, the population is employees at De Montfort University, with the total number of employees being ~2,700. To gather whole network data from a population of this size will be very difficult, arguably impossible. Indeed, in the recruitment of participants, this response rate was 40 per cent.

4.8 Epistemological considerations

It is acknowledged in this thesis that beyond the research approach taken, there is a deeper argument regarding what is to be considered as reality - *ontology* and to what extent can reality be known – *epistemology*. Within the ontological and epistemological fields there are several paradigmatic standpoints, each offering an alternative philosophical perspective on what can be considered to be known, and how this knowledge can be discovered.

Knowledge is said to have three components – knowledge that, knowledge how, and knowledge of (Fantl, 2012). 'Knowledge that' refers to propositional items, such as the knowledge that kangaroos hop, or that 2+2=4. 'Knowledge how' refers to procedural items, such as how to ride a bike and how to bake a cake, whereas 'knowledge of' refers to knowledge of the existence of things, such as places or people. Epistemology is concerned with the first of these three – 'knowledge that', and has three components that are all said to be required – belief, truth and justification, or, in combination, 'justified, true, beliefs' (Fantl, 2012).

In studies of epistemology there are several paradigmatic standpoints, each with different tendencies towards the discovery of 'justified, true, beliefs'. Two opposing standpoints are those of empiricism and constructivism. Empiricism acquires knowledge through *experience* and *observation*, collecting *evidence* (Creath, 2013). Empiricism is a central concept in science and the scientific method. The alternative, constructivism, suggests that any attempt at discovering knowledge can only be seen through the 'human' lens, and so therefore exists 'independently' of the world (Grier, 2012). The empiricism vs. constructivism debate can be usefully described as the difference between objectivism and subjectivism.

This thesis takes the empiricist approach to establishing knowledge through the collecting of evidence - *a posteriori* knowledge. This thesis follows in the tradition of assuming that attitudinal perspectives exist in the minds of humans as mental states (Breakwell, 1993). This assumption extends to the empiricists ability to discover and to represent these mental states, through abstract constructs, and measured through questionnaires. This assumption has led in the past to the development of several theories that are used to understand individual attitudinal perspectives in order to understand behaviour – theories such as the Stern *et al.* (1999) value-belief-norm theory, or Ajzen's (1991) theory of planned behaviour, or the Triandis (1977) theory of interpersonal behaviour. This thesis carries on in this tradition.

4.9 Chapter summary

This chapter has described the methodology that was used to collect data for this study. The chapter started with the development of the questionnaire that was used to collect 'attitudinal factor' data, following the Stern *et al.* (1999) value-belief-norm theory. The description covered the adaptation of items used in previous studies (e.g. Steg *et al.,* 2005), the development of seven proposals for use in this study to understand acceptability of policy, and the use of response scales. This was followed by a description of the data collection processes, covering recruitment of participants, the appointment between participant and researcher and the social network analysis tasks. The chapter concluded with an acknowledgement of alternative approaches that could have been taken to collect data, and a consideration of the epistemological position of the research in its assessment of what is considered to be knowledge.

Chapter 5 Exploring social networks and understanding attitudinal influences on policy acceptability

This is the first of two results chapters. There are three objectives that are covered by the analysis in this chapter, two of which have hypotheses. There are five research questions that guide the structure of the chapter (sections 5.3 to 5.7) Firstly, there is an exploration of the participants and response rates (section 5.2).

5.1 Objectives, hypotheses and research questions

This chapter specifically relates to objectives one, two and five:

Objective 1: *To understand attitudinal factors influencing acceptability of greenhouse gas emissions reduction policies, using the value-belief-norm theory*

Objective 2: *To explore employee social networks within a higher education institution*

Objective 5: *To test the full value-belief-norm theory*

Each of these objectives has a hypothesis:

Hypothesis 1: Individuals with pro-environmental attitudinal perspectives will be more likely to accept policies to reduce greenhouse gas emissions

Hypothesis 2: There is no hypothesis concerning the social networks at the higher education institution

Hypothesis 5: The expectation is that variables in the theory are significantly predicted by preceding variables in the theory, and less so by

variables ‘further back’ in the theory. The value-belief-norm theory will also be tested for mediation, with the expectation that a variable sufficiently mediates the relationship between variables immediately preceding and following it

A number of research questions are identified in order to meet the objectives:

- What are the characteristics of the social networks at DMU? (section 5.3)
- Are the items asked as part of the value-belief-norm theory measuring the latent constructs as intended? (section 5.4)
- Are there relationships between the acceptability of the seven policy proposals? (section 5.5)
- Do the constructs in the value-belief-norm theory explain variance in the acceptability of policies? (section 5.6)
- Are the constructs in the value-belief-norm theory related to each other? (section 5.7)

Table 11: Research questions addressed in chapter five

Research Question	Question detail	How the Question will be answered	Test
What are the characteristics of social networks at DMU? (5.3)	The characteristics of social networks at DMU are unknown - are networks small and densely connected, or large and sparsely connected, or a mixture of characteristics?	A count to assess the size (number of people) and proportion of ties present (density). Cluster analysis is used to group the networks into different types.	Count, network density, cluster analysis
Are the items asked as part of the VBN theory measuring the constructs as intended? (5.4)	46 items are asked as part of the VBN theory. These 46 items measure the seven latent constructs that make up the VBN theory.	The 46 items will be assessed as to how well they correlate with each other by using both principal components and reliability analysis	Principal components analysis, reliability analysis
Are there relationships between the acceptability of the seven policy proposals? (5.5)	The seven policy proposals are all measuring acceptability of DMU reducing greenhouse gas emissions. These tests will assess how well the acceptability of policy correlated with each other, and whether the seven proposals can be treated as one scale, or a number of smaller scales.	The seven policy proposals will be assessed as to how well they correlate with each other by using both principal components and reliability analysis.	Principal components analysis, reliability analysis
Do the constructs in the value-belief-norm theory explain variance in the acceptability of policies? (5.6)	The VBN theory was used to predict acceptability of policy. Did the constructs in the theory predict acceptability?	Regression analysis will assess the proportion of the variance in acceptability of policies accounted for by individual attitudinal factors	Regression Analysis
Are the constructs in the value-belief-norm theory related to each other? (5.7)	To test the causal chain nature of the relationships between variables in the VBN theory	The relationships between pairs of adjacent constructs will be assessed. Regressions analysis will assess how well variance in a construct is predicted by the preceding construct. Mediation analysis will assess the indirect relationships between constructs.	Regression analysis and mediation analysis

5.2 Participants and response rates

5.2.1 Participants

A total of 88 DMU employees met the researcher between January 25th and 31st March 2010. As was described in Chapter 4, these 88 DMU employees are referred to as 'egos' as it is their 'ego' network that was elicited in the social network task. The 88 egos, when responsing to the 'very close' name generator, selected a total of 606 fellow DMU employees. These fellow DMU employees are termed 'alters'.

As egos were freely allowed to select whomever they wanted from within the University as alters, some DMU employees were named by more than one ego. Of the 694 egos and alters, 86 were selected more than once. Removing duplicates resulted in 584 singly occurring DMU employees, either as egos or alters.

It is important to note, that duplicates are removed from some of the analysis, but included in others. For example, in the social networks section of this chapter, all 694 DMU employees (88 egos and 606 alters) are included; removing alters from a network would require an arbitrary decision as to which network to remove them from. However, for the VBN questionnaire data, the duplicate entries are removed as including them would leave sets of identical questionnaire responses in the data. Table 12 gives a full breakdown of the numbers of participants included in the study.

Table 12: Participants in the study; a) social networks, b) questionnaire data

a) Social Networks		
	N	%
Egos	88	12.7
Alters	606	87.3
Total	694	100

b) Questionnaire Data		
	N	%
Egos	88	15.1
Alters	496	84.9
Total	584	100

5.2.2 Response rates - questionnaire

Of the 584 individuals who received the questionnaire, *all* 88 egos completed the questionnaire on paper *during* their appointment with the researcher. Of the 496 alters, 317 completed and returned the questionnaire. The total response rate was 69.4 per cent. Of the 317 alters that completed the questionnaire, 281 completed the paper version, with the remaining 36 completing the online Survey Monkey version. A total of 172 alters did not complete the questionnaire (29.4 per cent). The response rate in this study is almost one standard deviation above the mean ($\bar{x}$=52.7 per cent, *SD*=20.4) of organisational survey response rates reported by Baruch and Holtom (2008).

Seven alters returned questionnaires that remain unidentified. In these instances, the paper copy of the questionnaire was returned to the researcher, but the unique identifier number was either removed or crossed out so that the participant could not be identified. These questionnaires are not included anywhere in the results. Table 13 shows a breakdown of the response rates and methods of response for the questionnaire.

Table 13: Response rate and method of response; a) questionnaire responses, b) response format

a) Questionnaire Responses

	N	%
Egos	88	15.1
Alters	317	54.3
Missing	172	29.4
Unidentified	7	1.2
Total	584	100

b) Response Format

		N	%
Egos	Paper	88	21.7
	Survey Monkey	0	0
Alters	Paper	281	69.4
	Survey Monkey	36	8.9
Total		405	100

5.2.3 Characteristics of the participants

Table 14 details the responses to the seven socio-demographic items. Seven items were included in the questionnaire to characterise participants (see Section 4.2.7 for a full description). All seven items were categorical. The option 'other' was not included for any of the seven items. The table shows the numbers and percentages for the sample of 405. The ratio of females to males is almost 60/40. Less than 2 per cent of participants were aged 16-24, or above 65 - the four categories in between however, were almost evenly represented. The split of 'support' to 'academic' employees was close to 60/40. More than 80 per cent were full-time employees. Nearly 40 per cent have worked at DMU for more than 10 years. The sample was highly educated with more than 80 per cent having an undergraduate degree, and at least 50 per cent holding a postgraduate qualification. More than 40 per cent earn less than £30,000 per annum, with a further 40 per cent earning between £30,000-50,000 per annum, and 15 per cent earning more than £50,000 per annum; over 5 per cent decided not to answer the income item.

Table 14: Characteristics of the participants

Category	Response options	*N*	%	% (Excl. missing)
Gender	Male	166	41.0	41.5
	Female	234	57.8	58.5
	Missing	5	1.2	0
Age	16-24	6	1.5	1.5
	25-34	84	20.7	20.8
	35-44	111	27.4	27.5
	45-54	121	29.9	30
	55-64	80	19.8	19.9
	65+	1	0.2	0.2
	Missing	2	0.5	0
Job Type	Academic - Teaching	120	29.6	29.9
	Academic - Research	40	9.9	10
	Support - Admin	168	41.5	41.8
	Support - Teaching	6	1.5	1.5
	Support - Research	68	16.8	16.9
	Missing	3	0.7	0
Employment Status	Full-Time	330	81.5	81.9
	Part-Time	73	18.0	18.1
	Missing	2	0.5	0
Time at DMU	< 1 year	29	7.2	7.2
	1-3 yrs	68	16.8	16.9
	3-5yrs	74	18.3	18.4
	5-10yrs	76	18.8	18.9
	10+ yrs	156	38.5	38.7
	Missing	2	0.5	0
Qualifications	GCSE	28	6.9	7.1
	A-Level	37	9.1	9.3
	UG Degree	125	30.9	31.5
	PG Degree	133	32.8	33.5
	Doctorate	74	18.3	18.6
	Missing	8	2.0	0
Income	< £10k	4	1.0	1
	10-20k	54	13.3	14.1
	20-30k	102	25.2	26.6
	30-40k	88	21.7	23.0
	40-50k	72	17.8	18.8
	50-60k	48	11.9	12.5
	60k +	15	3.7	3.9
	Missing	26	6.4	0

5.3 What are the characteristics of social networks at DMU?

In this section of the results chapter, the network data collected in the study are explored. As described in section 5.2, 88 egos were met, and they elicited the names of 606 alters whom they felt met the 'very close' criteria.

This section begins by characterising the network types within the University, using three characteristics of each network – network size, network ties and network tie density. Characterising the networks in this way allows a more parsimonious view of the network data, once data analysis is used to reduce the networks into a smaller number of network types. Table 15 provides a summary of the network characteristics described in sections 5.3.1 through to 5.3.3.

5.3.1 Network size

Network size is a simple measure of how many individuals are in a network. Each of the 88 networks has one ego, and a range from zero to 26 alters. The mean network size in this study was 7.89 people, with a standard deviation of 4.81 people. Figure 5 shows a histogram of network size.

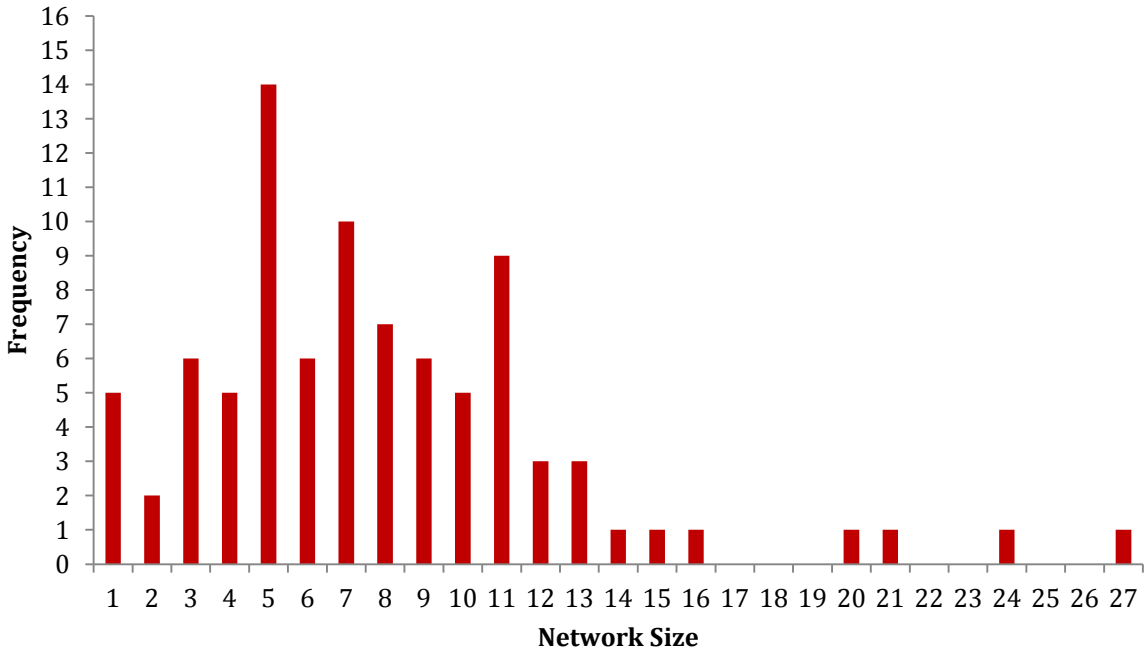

Figure 5: Column chart showing quantity of networks by size of network

5.3.2 Network ties

A network tie is a connection between two individuals. In this study, a connection between two individuals indicates that they are ‘very close’ to each other, and can occur between an ego and an alter, or between two alters.

In this study there are a total of 3,072 ties. This however, counts each tie connecting two individuals twice – once from A to B, and again from B to A. Halving the 3,072 ties gives 1,536 singly occurring ties. Of the 1,536 ties, 606 are between an ego and an alter, and 930 are between two alters. The mean number of ties (1,536/88) in a network is 17.45 ties with a standard deviation of 47.35 ties.

5.3.3 Network tie density

Tie density is a measure of the number of ties that are present in a network as a proportion of the total possible (Wasserman and Faust, 1994). The maximum number of ties possible in a network requires that every individual in the network be connected to every other individual. For example, for a network with just two individuals, the maximum is one tie; for a network with three individuals there is a maximum of two ties; for a network with four individuals, the maximum is six ties. The following equation is used to calculate the maximum number of ties possible in a network *(*where *n* is the number of individuals in the network):

$$\frac{n * (n - 1)}{2}$$

To calculate tie density, 100 is divided by the maximum number of possible ties, and multiplied by the actual number of ties. This is shown as follows, where *k* is the number of ties:

$$100/(n * \frac{n - 1}{2}) * k$$

Network characteristics are summarised in Table 15. The mean density across the 88 networks is .535, indicating that on average, just over half of the connections between individuals are realised.

Table 15: Characteristics of the networks

	Minimum	Maximum	Mean	Standard Deviation
Total Size	1	27	7.89	4.81
Alters	0	26	6.9	4.81
Ties	0	314	17.45	47.35
Density	0	1	.535	.25

5.3.4 Network size, ties and density combined

Bringing the three network characteristics – size, ties and density – together, allows an estimation of the relationships between the three. Figure 6 shows the relationship between the size of the network, and the number of ties present. As is expected - as the number of individuals in each network increases, the number of ties increases in an exponential manner. A curvilinear relationship exists (R^2= .91).

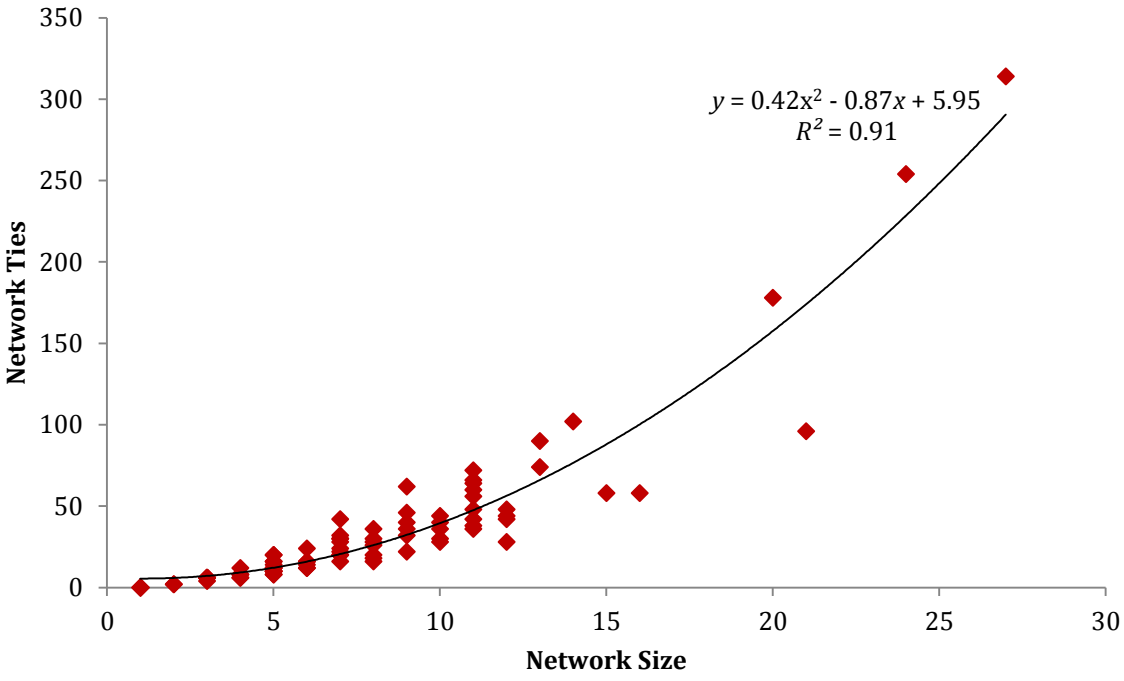

Figure 6: Scatterplot showing relationship between number of ties and network size

5.3.5 Data reduction

In this study there are 88 networks, comprising a total of 696 individuals and 1,536 singly occurring connections. Here, cluster analysis is used to group the 88 networks based upon these observable characteristics. Grouping the networks allows a parsimonious discussion of the types of networks that exist at DMU.

5.3.6 Cluster analysis

Cluster analysis is a data reduction technique that uses similarities in a data set to group data points (Field, 2009). By treating data points that are similar as belonging to one type or group, a more parsimonious analysis of the data can be conducted. Each network can be assigned to a group or type based upon their characteristics such as their size and tie density (Bellotti, 2008).

Figure 7 shows a scatter plot with the size (y-axis) and tie density (x-axis) characteristics of each of the 88 networks (note: there are not 88 data points, as some are overlay each other). A visual analysis of the scatterplot begins to

provide an insight into the number of clusters that might be present. It is clear from a visual inspection that there are at least five groups - a group with size 1, and a tie density of zero (left hand side, bottom corner); a group of networks with a tie density of 1, that always have size less than 10 individuals (far right hand side); a group of three networks with a tie density of 0.5, with a large size of above 20 individuals (top, middle), a group of three or four networks, also with a large size (above 12), but with a low tie density, less than 0.3 (centre-left, middle) and a large and dissimilar group with a tie density of between 0.3-0.9 and a size of between 3 and 12 individuals. This final group may be divided based upon the results of the cluster analysis.

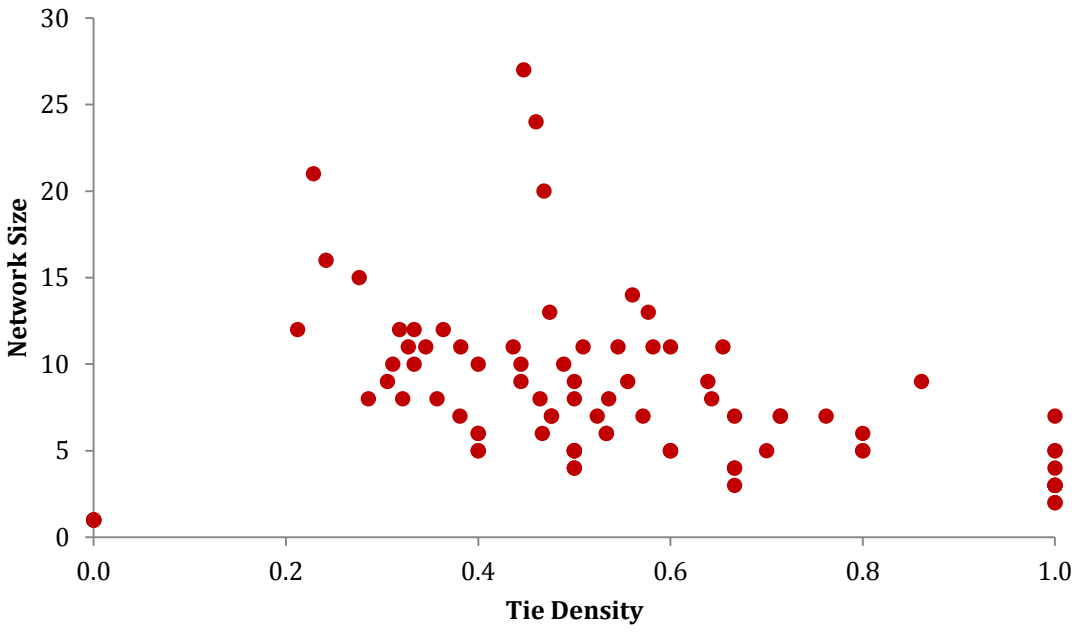

Figure 7: Scatterplot of tie density vs. network size

In cluster analysis, there are three clustering techniques: 'hierarchical', 'k-means' and 'two-step'. 'K-means' and 'two-step' both require the researcher to know in advance how many clusters are desired. 'Hierarchical' clustering is exploratory in comparison, and allows the researcher to produce a number of clustering solutions and decide upon which is most appropriate based on the output from the analysis (Field, 2009).

In this study, the hierarchical clustering method was chosen as it was not clear, prior to analysis, how may clusters were required. Eleven solutions were calculated, with between two and 12 clusters. The number of networks in each cluster is shown in Table 16.

Table 16: Cluster analysis results

	12 Cluster solution	11 Cluster solution	10 Cluster solution	9 Cluster solution	8 Cluster solution	7 Cluster solution	**6 Cluster solution**	5 Cluster solution	4 Cluster solution	3 Cluster solution	2 Cluster solution
Cluster 1	3	3	3	3	3	3	**4**	4	7	7	83
Cluster 2	2	2	2	3	3	3	**3**	3	65	76	5
Cluster 3	15	15	15	15	27	48	**48**	65	11	5	
Cluster 4	12	12	12	12	21	17	**17**	11	5		
Cluster 5	21	21	21	21	17	11	**11**	5			
Cluster 6	13	13	17	17	11	5	**5**				
Cluster 7	11	11	11	11	5	1					
Cluster 8	3	4	5	5	1						
Cluster 9	5	5	1	1							
Cluster 10	1	1	1								
Cluster 11	1	1									
Cluster 12	1										

Table 16 shows that the two cluster solution (far right-hand-side column, red text) separates the 88 networks into two groups; one group of 83 networks and one of five networks. The five networks are size = 1, tie density = 0 (shown as a single dot, bottom left corner in Figure 7). Although this solution satisfactorily separates out the networks with only one individual, the overall solution is unsatisfactory, as it does not granulate the data finely enough. Looking at

Figure 7 prior to cluster analysis, it was clear that there were at least five clusters. In the three, four and five cluster solutions (blue text), one of the clusters in each solution contains 65 or more of the networks. Indeed the five cluster solution represents the expected separation of the networks.

In the seven to 12 cluster solutions (green text), at least one cluster is created that contains only one network. Looking at Figure 7, a cluster that contains only one network does not seem to be an obvious solution as there are no single networks that appear to be significantly different to the rest of the networks, such that they should be separated from the rest of the networks (the single dot in the bottom left hand corner represents five networks).

In the six-cluster solution (**bold** font in Table 16), three small clusters are created with five or fewer networks in each cluster, all of which were clear from the initial scatterplot. The remaining three clusters cover 76 networks. These three groups differ greatly in their size, from a low of two individuals to a high of 14 individuals, and their tie density ranges from a low of .29 to a high of 1. The six cluster (**bold font**) solution appears to be the best way of dividing the 88 networks into a sensible number of clusters based upon the size and tie density characteristics.

Figure 8 shows the same data as Figure 7, but with the networks coloured and shaped according on their cluster membership. A summary of the characteristics of the six clusters is shown in Table 17. A description of the characteristics of the networks in each cluster is made in the text following Table 17, alongside visual representations of the 88 networks in their clusters.

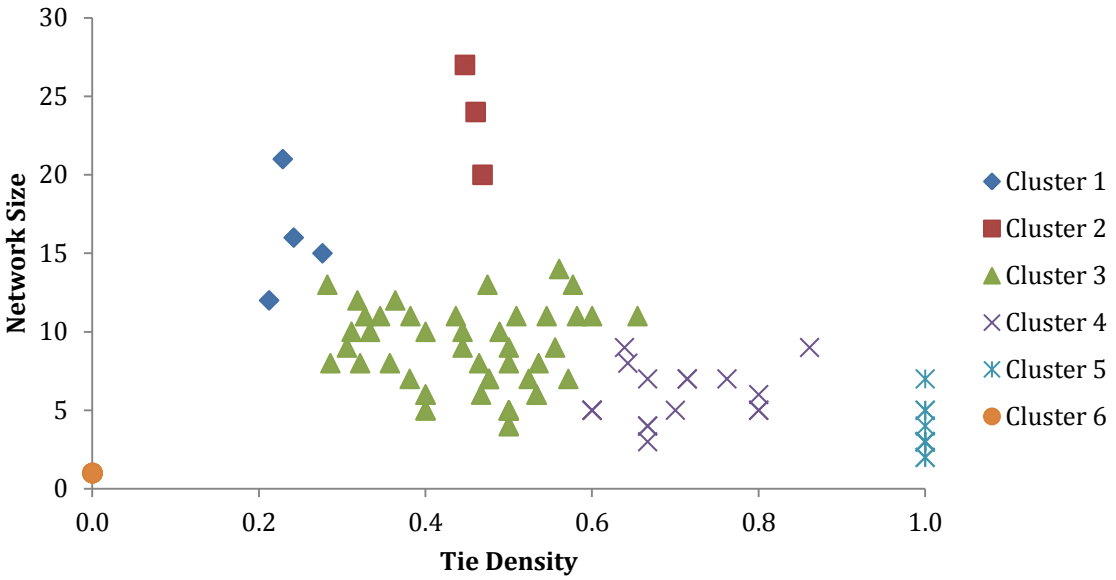

Figure 8: Scatterplot of tie density vs. network size after cluster analysis

Table 17: Characteristics of the clusters

	# Networks	Network Size				Tie Density			
		Min	Max	Mean	St. Dev	Min	Max	Mean	St. Dev
Cluster 1	4	12	21	17.60	3.75	.21	.28	0.24	.027
Cluster 2	3	20	27	23.67	3.51	.45	.47	0.46	.011
Cluster 3	48	4	14	8.58	2.66	.29	.65	0.45	.091
Cluster 4	17	3	9	5.94	1.75	.60	.86	0.70	.080
Cluster 5	11	2	7	3.64	1.50	1.00	1.00	1.00	0
Cluster 6	5	1	1	1	0	.00	.00	0.00	0

The first cluster consists of four networks, all of which are large in size, between 12 and 21 people, and all have a low tie-density, less than 0.3. These are represented as blue diamonds in Figure 8. A sociogram of each of the networks in cluster one is shown in Figure 9. In these four networks, alters typically have a small number of connections to other alters, with some only having a connection to ego. The three networks in cluster two have a large size, 20+ people, and a tie-density close to the mean of all 88 networks. These are shown as red squares in Figure 8. A sociogram of each of the networks in cluster two is shown in Figure 10. In these three networks, there is typically a very well connected cluster of alters, and then there are also several other alters who are

less well connected to each other, and somewhat distant from the large cluster. Cluster 3 contains over half of the networks in this study (*N*=48). These networks have between five and 15 nodes (~ one standard deviation above and below the mean of all 88 networks) and a low to average tie-density of between 0.3 and 0.5. These networks are shown as green triangles in Figure 8. A sociogram of each of the networks in cluster three is shown in Figure 11. The 17 networks in cluster four have a tie density above the mean for the 88 networks (0.6-0.86), and are less than 10 people in size. They are shown as purple crosses in Figure 8. A sociogram of each of the networks in cluster four is shown in Figure 12. The 11 networks in cluster five have a small number of people, always less than the mean, and a mean tie-density of 1 (all possible connections are always made). These networks are shown as blue crosses in Figure 8. A sociogram of each of the networks in cluster five is shown in Figure 13. These networks are similar to those in cluster 4, but are smaller making having all ties present more likely. The final cluster, cluster six contains networks with only one person - ego, and therefore no tie density. These are shown as an orange dot in Figure 8. A sociogram of each of the networks in cluster six is shown in Figure 14. These represent networks where ego felt that they were not ‘very close’ to any of their colleagues. The visualisation of networks in the six cluster groupings has allowed confirmation of intra-group similarity and inter-group dissimilarity.

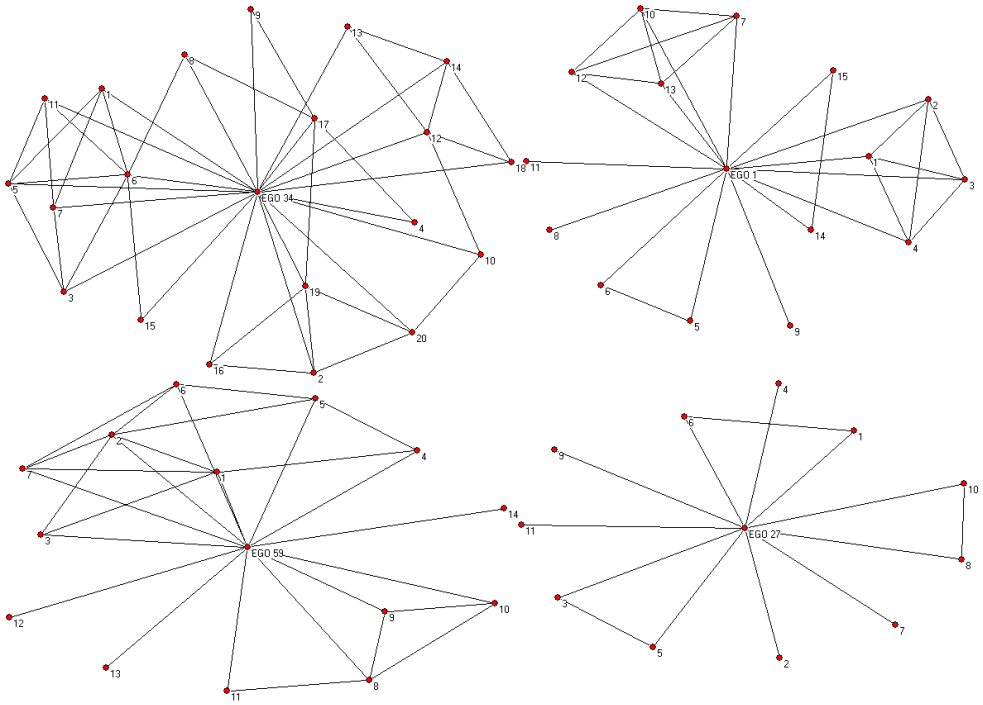

Figure 9: Sociograms of the four networks in cluster 1 – large size, low tie density

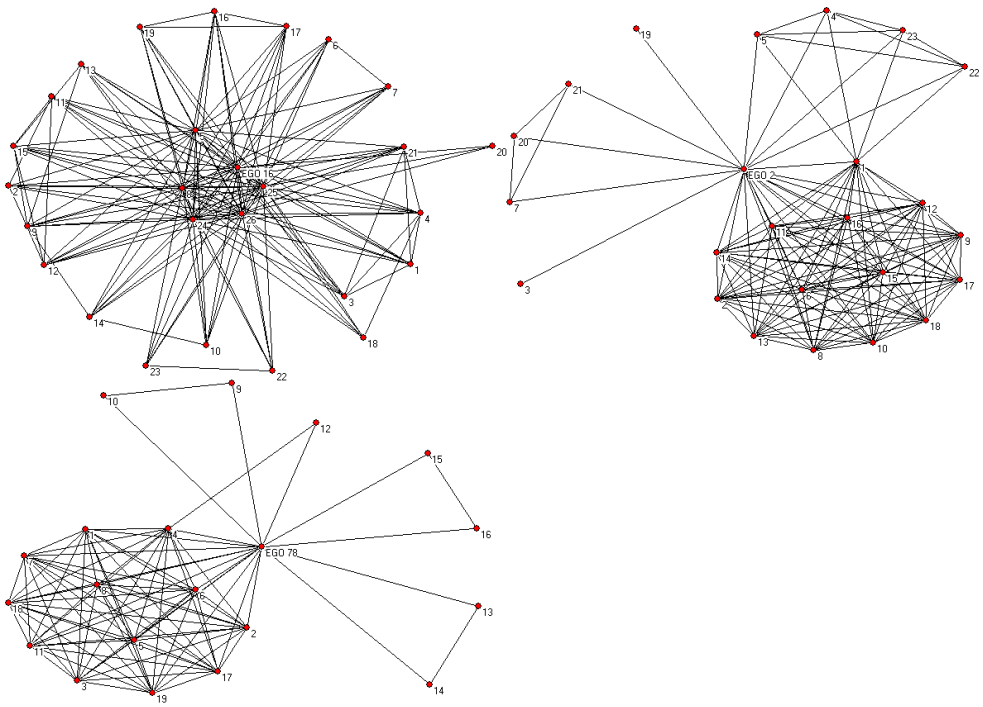

Figure 10: Sociograms of the three networks in cluster 2 – large size, slightly below average tie density

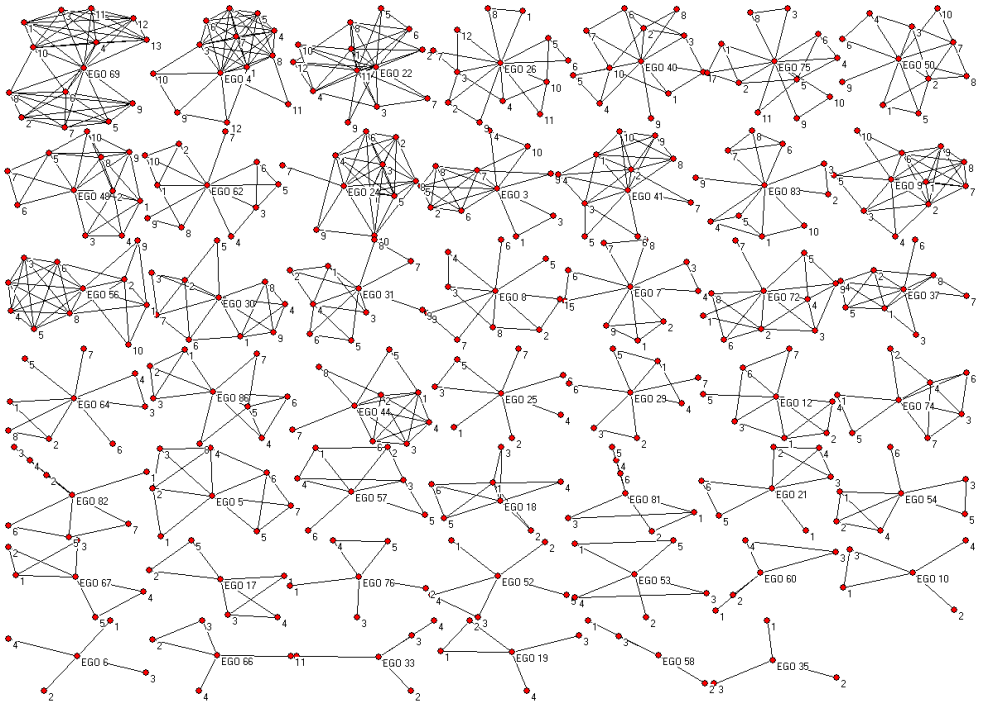

Figure 11: Sociograms of the 48 networks in cluster 3 – average size and tie density

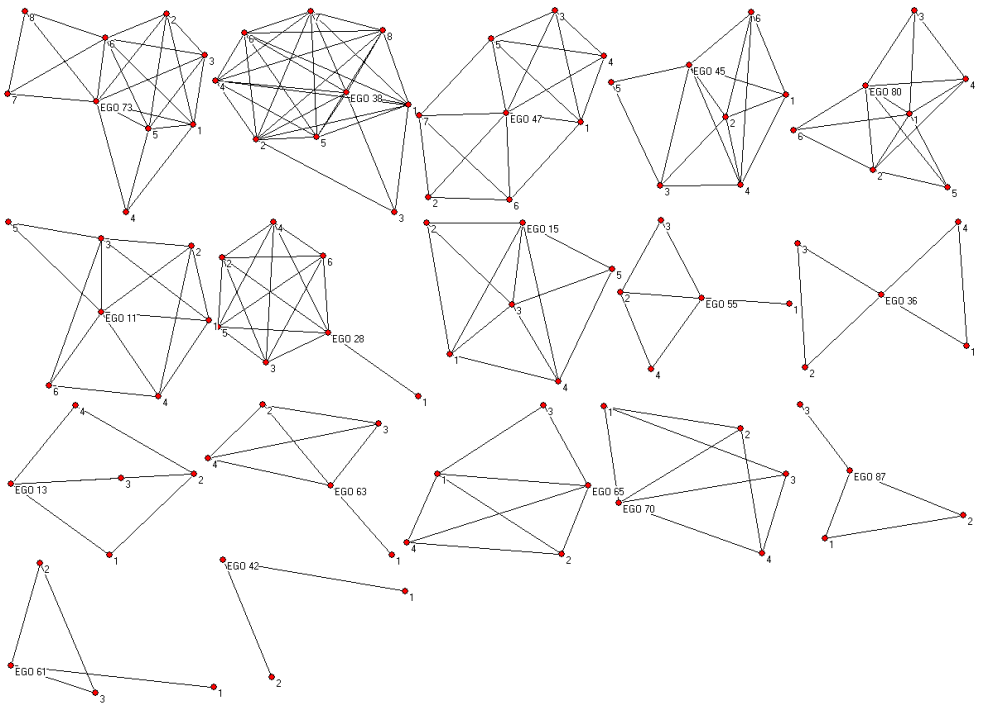

Figure 12: Sociograms of the 17 networks in cluster 4 – small networks with a high tie density

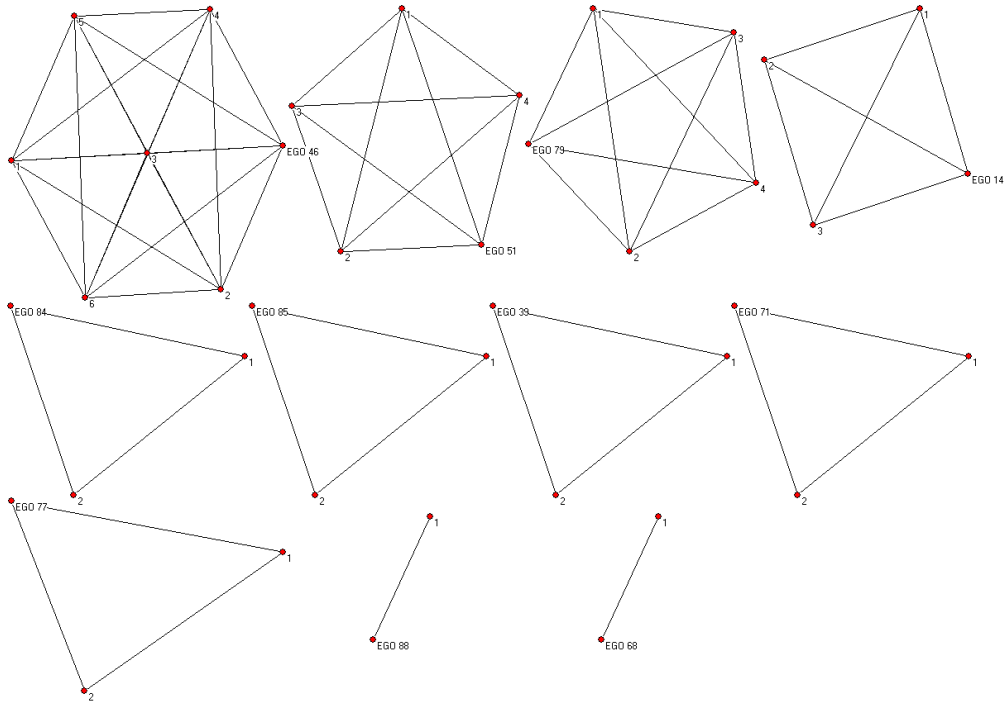

Figure 13: Sociograms of the 11 networks in cluster 5 – small networks with a tie density of 1

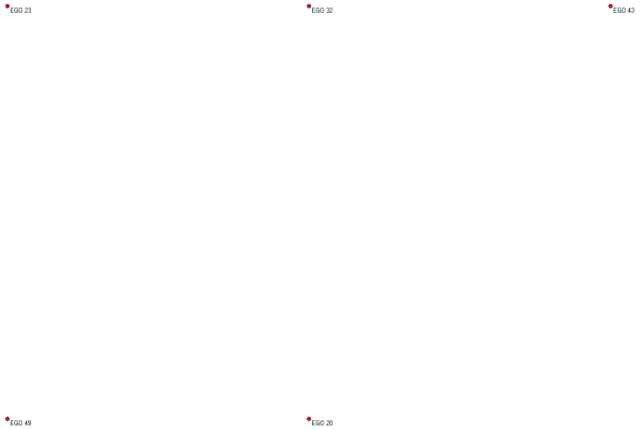

Figure 14: Sociograms of the five networks in cluster 6 – one person in each network, no ties

The exploration of social networks at DMU has allowed for the identification of six types of networks. The 88 networks that have been explored have varying characteristics, from small one-person networks to large 20+ person networks, and with varying levels of tie density. Before further analysis of social networks, it is necessary to examine the questionnaire data. In sections 5.4, 5.5, 5.6 and 5.7 the data gathered using the questionnaire are analysed.

5.4 Are the items asked as part of the value-belief-norm theory measuring the constructs as intended?

As described in section 5.2.2, 405 individuals completed and returned the questionnaire. Eighty-eight of the 405 were egos who completed and returned the questionnaire during the appointment with the researcher, 317 participated as alters, with 36 of these completing the online survey monkey version of the survey. For the purposes of this section of the analysis, all 405 questionnaire responses are analysed together - no further distinction is made between those that completed the survey as egos or alters, online or paper. All individuals have completed the same items, responding using exactly the same response options. There is no need to differentiate given the analysis that is presented in the remainder of this chapter.

As described in Chapter 4, the questionnaire followed the value-belief-norm (VBN) theory (Stern *et al.,* 1999; Stern, 2000). The theory proposes a causal relationship between seven latent constructs. The theory has been used in this study in the same format as originally proposed, by asking questions that seek to ‘tap’ or measure the seven latent constructs. The questionnaire contained 46 items. In addition to the 46 items asked as part of the VBN theory, seven items were asked to understand acceptability judgements towards initiatives that De Montfort University could put into place to reduce its greenhouse gas emissions (the dependent variables for the study).

To analyse the latent constructs in the VBN theory, and the causal relationships between the constructs, a number of statistical tests were used. Principal components analysis is used to assess whether items measured the latent

constructs they were intended to. An assessment is then made of the reliability of each set of items to measure a specific construct. Once each set of items has been assessed as to its suitability for measuring each latent construct, the relationship between the constructs is tested with a combination of regression and mediation analyses. Each of the techniques identified is explained in more detail alongside the results when analysing the data. Figure 15 shows the VBN theory constructs and the proposed causal links between them.

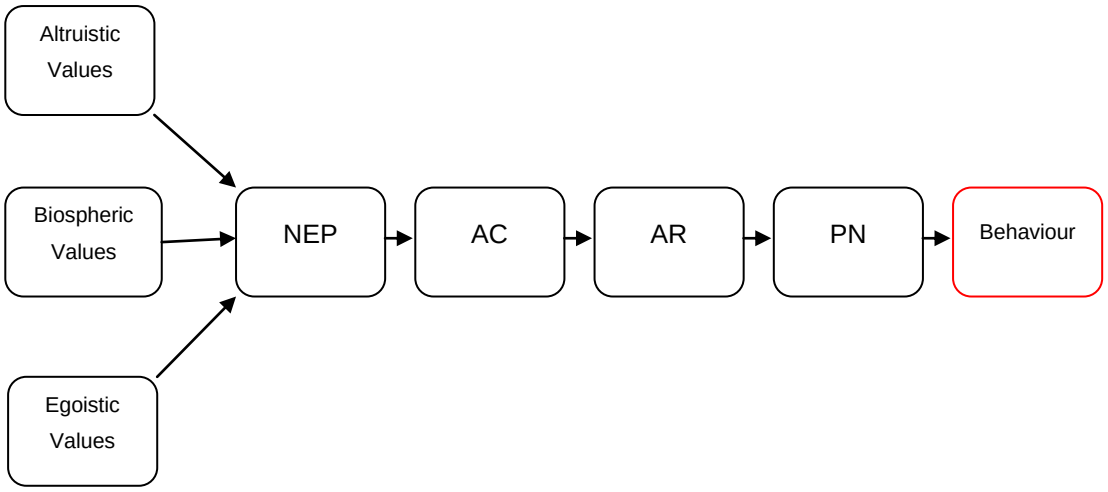

Figure 15: A schematic of the value-belief-norm (VBN) theory (*cf*. Stern 2000)

5.4.1 Descriptive statistics

Table 18 through to Table 20 show descriptive statistics for each of the 46 items used in the VBN theory. When used in data analysis, as they are here, items are referred to as variables. Table 18 shows statistics for the 13 values variables. For the values variables, responses were on a scale from -1 to 7, with higher values representing greater importance of the value to the individual. Missing answers were entered into the spreadsheet as blanks (hence *N* not being 405 for each variable).

Table 18: Descriptive statistics for the variables intended to measure values

Intended Construct	Variable	*N*	Min	Max	Mean	Std. Deviation
Altruistic	Equality (*equal opportunity for all)*	403	0	7	5.51	1.48
Altruistic	A World at Peace – (*free of war and conflict)*	402	0	7	5.36	1.64
Altruistic	Social Justice – (*correcting injustice, care for the weak)*	404	1	7	5.35	1.41
Altruistic	Helpful - (*working for the welfare of others)*	405	1	7	4.94	1.45
Biospheric	Respecting the Earth (*harmony with other species)*	401	0	7	4.82	1.60
Biospheric	Unity with Nature (*fitting into nature)*	400	-1	7	4.03	1.80
Biospheric	Protecting the Environment – (*preserving nature)*	402	0	7	4.96	1.56
Biospheric	Preventing Pollution – (*protection of natural resources)*	402	-1	7	4.71	1.58
Egoistic	Social Power (*control over others, dominance)*	400	-1	7	0.96	1.82
Egoistic	Wealth – (*material possessions, money)*	404	-1	7	2.57	1.60
Egoistic	Authority – (*the right to lead or command)*	399	-1	7	2.11	1.81
Egoistic	Influential – (*having an impact on people and events)*	401	-1	7	3.42	1.78
Egoistic	Ambitious – (*hardworking, aspiring)*	404	-1	7	4.24	1.78

Table 19 shows statistics for the 15 new environmental paradigm (NEP) variables. Variables marked with an asterisk are negatively worded. Variables not marked with an asterisk are positively worded and a higher value equals a greater *acceptance* of the belief. For the NEP section, responses were on a one to five scale, one being 'strongly disagree' and five being 'strongly agree', centred on 'unsure'. Variables with a * were reverse coded when recorded.

Table 20 shows statistics for the six awareness of consequences (AC); six ascription of responsibility (AR) and six personal norms (PN) variables. Variables are presented in the same way that they are for the NEP variables. Responses were on a one to five scale of 'strongly disagree' to 'strongly agree' centred on 'neither agree nor disagree'. An additional response column 'don't know' was used. Missing responses or responses of 'don't know' were entered into the spreadsheet as blanks. Variables with a * were reverse coded when recorded.

Table 19: Descriptive statistics for the variables intended to measure the NEP

Variable	*N*	Min	Max	Mean	Std. Deviation
We are approaching the limit of the number of people the Earth can support	393	1	5	3.41	1.03
*Humans have the right to modify the natural environment to suit their needs	392	1	5	3.11	0.97
When humans interfere with nature it often produces disastrous consequences	391	1	5	3.54	0.94
*Human ingenuity will ensure that we do not make the Earth unliveable	392	1	5	3.00	0.86
Humans are severely abusing the environment	393	1	5	3.93	0.85
*The Earth has plenty of natural resources if we just learn how to develop them	395	1	5	2.62	0.95
Plants and animals have as much right as humans to exist	394	1	5	3.99	0.94
*The balance of nature is strong enough to cope with the impacts of modern industrial nations	394	1	5	3.61	0.84
Despite our special abilities, humans are still subject to the laws of nature	394	1	5	4.13	0.63
*The so-called “ecological crisis” facing humankind has been greatly exaggerated	395	1	5	3.54	0.95
The Earth is like a spaceship with very limited room and resources	390	1	5	3.32	0.96
*Humans were meant to rule over the rest of nature	392	1	5	3.74	0.96
The balance of nature is very delicate and easily upset	391	1	5	3.69	0.89
*Humans will eventually learn enough about how nature works to be able to control it	394	1	5	3.32	0.89
If things continue on their present course, we will soon experience a major ecological catastrophe	394	1	5	3.49	0.87

Table 20: Descriptive statistics for the variables intended to measure NAT constructs

Intended Construct	Variable	*N*	Min	Max	Mean	Std. Deviation
AC	* Burning fossil fuels does not contribute to global climate change	385	1	5	3.92	0.91
AC	Environmental quality will improve if we emit less greenhouse gases	382	1	5	3.98	0.71
AC	Global climate change is a problem for society	394	1	5	4.28	0.73
AC	Reducing greenhouse gas emissions helps to reduce the effects of global climate change	378	1	5	3.98	0.78
AC	* It is not certain whether greenhouse gas emissions cause global climate change	369	1	5	3.46	1.03
AC	Global climate change causes extreme weather events such as flooding or droughts	347	1	5	3.79	0.90
AR	* Because my personal contribution is very small I do not feel responsible for global climate change	398	1	5	3.55	0.86
AR	* I do not feel personally responsible for my emissions of greenhouse gases	401	1	5	3.62	0.90
AR	I feel personally responsible for my contribution towards the global climate change problem	395	1	5	3.44	0.95
AR	* The government and industry are responsible for greenhouse gas emissions, not me	394	1	5	3.59	0.92
AR	I feel jointly responsible for worldwide greenhouse gas emissions	390	1	5	3.39	0.90
AR	* Individuals on their own cannot contribute to the reduction of greenhouse gas emissions	394	1	5	3.61	1.00
PN	People like me should do everything they can to reduce their greenhouse gas emissions	399	1	5	3.98	0.78
PN	I feel personally obliged to bear global climate change in mind in my daily behaviour	400	1	5	3.64	0.95
PN	* I would not feel morally obliged to bear fuel efficiency in mind were I to purchase a car	399	1	5	3.61	1.02
PN	I do feel morally obliged to reduce my greenhouse gas emissions, regardless of what others do	400	1	5	3.77	0.89
PN	I feel personally obliged to reduce my greenhouse gas emissions as much as possible	395	1	5	3.77	0.81
PN	I do feel morally obliged to use public transport whenever I can	400	1	5	3.03	1.07

5.4.2 Data reduction

The 46 variables in the questionnaire were designed to measure seven latent psychological constructs. Analysing the variance in each of the 46 variables allows for an understanding of the correlated nature of the relationship between variables, and the uncorrelated relationship between the constructs that they were intended to measure (Field, 2009).

In the present study, principle components analysis (PCA) was selected as the data reduction technique. PCA analyses the total variation in each variable, reducing the number of variables to a subset that explains the maximum amount of variance in a construct (Field, 2009). The alternative, factor analysis, differentiates between the common and unique variance, explaining only the common variance - each variable has an amount of variation that is unique to that variable, and that is not common with any of the other variables in the study. Factor analysis does not include this variance, hence the choice of principal components analysis (Dunteman and Lewis-Beck, 1994).

Thirty-one of the 46 variables included in the questionnaire were included in the PCA, representing six of the seven constructs in the VBN theory. The 15 variables that were used to measure the NEP construct were not included. In many studies previous to this, the NEP has been found to encompass several differing components – some studies report the NEP as having one, two, three or even four components (Dunlap, 2008; Hawcroft and Milfont, 2010). The VBN theory is designed such that the NEP scale is included as a *single* construct (e.g. Steg *et al.,* 2005). Although Stern *et al.* (1999) use a subset of five of the 15 NEP variables when proposing the VBN theory the five that they select do not correlate with the dimensions identified in NEP meta-analysis studies (Hawcroft and Milfont, 2010; Dunlap, 2008).

A number of studies suggest treating the NEP as measuring one construct to be the most appropriate method of using the NEP. Hawcroft and Milfont (2010:146) found that “a large number of recent studies, especially those using the revised NEP scale, typically sum all items into a single measure…they treat the items

as measuring one construct even if uni-dimensionality is not found". This is also the method employed by Dunlap and Van Liere and Dunlap *et al.* in both 1978 and 2000, where the NEP was introduced and subsequently revised (α= .81 & .83, inter-item correlation .46 & .45 respectively), and it is also the method used by Steg *et al.* (2005), α= .73 (inter-item correlation not reported). For the reasons explained above, the full 15-item NEP will be used in the remainder of the analysis, as a single measure, and is not included in the PCA.

A PCA of the 31 variables was calculated using SPSS version 19. Oblique, as opposed to orthogonal rotation was employed. Orthogonal rotation assumes that none of the factors correlate, which is often not the case in psychology (Field, 2009). Oblique rotation allows correlation between factors. Results for a specific type of oblique rotation 'direct oblimin' are reported in this study. The alternative method, using a 'promax' rotation was calculated, with variables falling into the *same structure* as the direct oblimin method. Direct oblimin was chosen over promax as a rotation method as it provides the simplest solution. The promax rotation produced several *complex variables*. Complex variables have component loadings >.3 for more than one component (Thurstone, 1947).

Figure 16 shows the scree plot for the PCA, with the point of inflexion at the sixth component, suggesting a six component solution. The six component solution explained 58.69 per cent of the variance in the 31 variables. Components with an eigenvalue >1 were retained following Kaiser's criterion. The seventh component did not meet Kaiser's criterion (eigenvalue of .934) and explained only an additional 3.01 per cent of the variance. Missing data were dealt with by using pairwise deletion. Listwise deletion reduced the sample size from 405 to 272. The Kaiser-Meyer-Olkin measure of sampling adequacy (the ratio of squared correlation between variables to squared partial correlation between variables (Field, 2009)), returned a value of .90. Values above .6 are generally accepted (Field, 2009). Bartlett's test of sphericity, the null hypothesis that the variables in the correlation matrix are uncorrelated, is rejected (*p* .000) justifying data reduction techniques. To produce the pattern matrix, 20 iterations were required.

Oblique rotation produces both a *pattern* and a *structure* matrix. Squaring the values in the pattern matrix gives the unique contribution of each factor to the variance of each variable (Tabachnick and Fidell, 2007). The structure matrix offers a more complex view of the data, accounting for relationships shown in the pattern matrix, plus the relationship between variables and overlapping variance among the factors. Typically, the pattern matrix is used to inform the relationships between variables and factors, although both are reported (Tabachnick and Fidell, 2007).

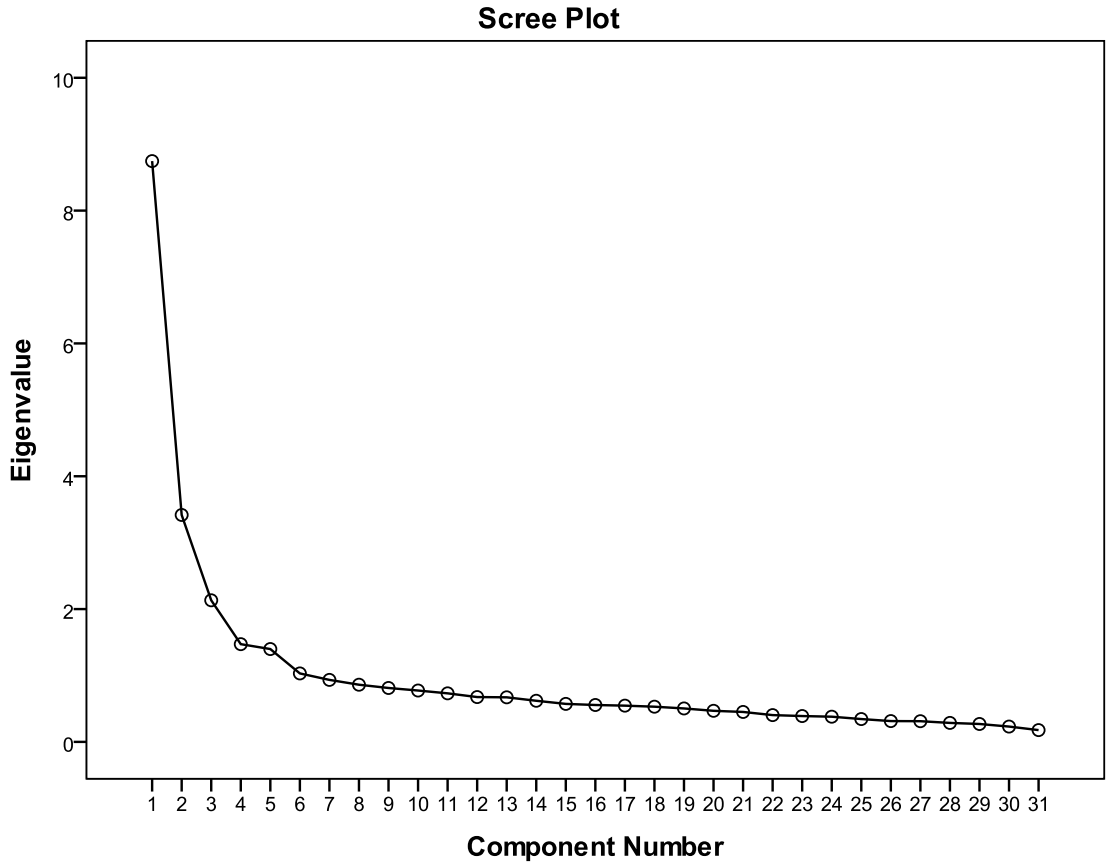

Figure 16: A scree plot of the components found in the value-belief-norm theory

Table 21 and Table 22 show the pattern and structure matrices for the 31 variables included in the PCA. Where a variable loading is above .3 or below -.3 in both the pattern and structure matrices for the construct that it *was intended* to measure, the loading is in **bold** font. Where the loading for the variable is above .3 or below -.3, but for a construct that it *was not intended* to measure,

the loading is in red text. Variables that loaded *highest* on a construct they were *not intended* to measure are highlighted grey, and were excluded from further analysis. Variables that did not meet the minimum 0.3 factor loading score for both the pattern and structure matrices for any construct are also highlighted grey and were excluded from further analysis.

Three variables were excluded because of the results from principal components analysis (highlighted grey in the pattern matrix). For the AR construct, the fifth set of items in Table 20 and Table 21, for both the pattern and structure matrices, “I feel personally responsible for my contribution towards the global climate change problem” (row 22) and “I feel jointly responsible for worldwide greenhouse gas emissions” (row 24) only have acceptable component loadings for the PN construct, and so were removed.

A variable intended to measure the PN construct, the sixth set of items in Table 20 and Table 21, “I would not feel morally obliged to bear fuel efficiency in mind were I to purchase a car” (row 28) has no component loadings >.3 in the pattern matrix, but component loadings >.3 for AC, AR and PN in the structure matrix (with the highest component loading for the PN construct .450). Due to the low score in the pattern matrix, and complex triple-loading score in the structure matrix, this variable was also removed from further analysis.

Table 21: Pattern matrix of variables to measure six constructs from the VBN theory

Variable	*N*	Component					
		Alt	Bio	Ego	AC	AR	PN
Equality (*equal opportunity for all)*	403	**.618**	-.157	-.003	-.013	-.016	.069
A World at Peace (*free of war and conflict)*	402	**.536**	-.461	-.111	.066	.224	.003
Social Justice (*correcting injustice, care for the weak)*	404	**.676**	-.250	-.075	-.081	-.151	-.004
Helpful (*working for the welfare of others)*	405	**.763**	-.026	.100	-.001	.065	.070
Respecting the Earth (*harmony with other species)*	401	.086	**-.797**	-.030	.017	-.012	.042
Unity with Nature (*fitting into nature)*	400	-.043	**-.888**	-.004	-.034	.035	.007
Protecting the Environment (*preserving nature)*	402	.092	**-.818**	.041	.099	-.114	-.036
Preventing Pollution (*protection of natural resources)*	402	.112	**-.731**	.117	.066	-.029	.064
Social Power (*control over others, dominance)*	400	-.285	-.171	**.577**	-.293	.218	.243
Wealth (*material possessions, money)*	404	-.211	-.009	**.731**	.110	-.072	-.215
Authority (*the right to lead or command)*	399	-.031	-.067	**.808**	-.137	-.054	.029
Influential (*having an impact on people and events)*	401	.385	-.035	**.633**	.030	-.013	-.002
Ambitious (*hardworking, aspiring)*	404	.422	.153	**.643**	.119	.017	-.049
Burning fossil fuels does not contribute to global climate change	385	-.089	-.095	-.036	**.579**	-.324	-.172
Environmental quality will improve if we emit less greenhouse gases	382	-.052	-.102	-.019	**.645**	.058	.104
Global climate change is a problem for society	394	-.061	-.033	.047	**.558**	.084	.367
Reducing greenhouse gas emissions helps to reduce the effects of global climate change	378	.003	-.088	.013	**.703**	.010	.186
It is not certain whether greenhouse gas emissions cause global climate change	369	.111	.038	-.022	**.721**	-.077	.043
Global climate change causes extreme weather events such as flooding or droughts	347	.017	-.020	.012	**.584**	.264	.341
Because my personal contribution is very small I do not feel responsible for global climate change	398	.050	-.046	.012	.018	**-.502**	.430
I do not feel personally responsible for my emissions of greenhouse gases	401	.059	-.003	-.039	.122	**-.553**	.223
I feel personally responsible for my contribution towards the global climate change problem	395	.036	.026	-.072	.069	-.143	.728
The government and industry are responsible for greenhouse gas emissions, not me	394	.080	.117	-.011	-.116	**-.627**	.281
I feel jointly responsible for worldwide greenhouse gas emissions	390	.016	.096	.011	.086	-.151	.651
Individuals on their own cannot contribute to the reduction of greenhouse gas emissions	394	-.097	-.179	.062	.108	**-.653**	.045
People like me should do everything they can to reduce their greenhouse gas emissions	399	-.047	-.073	.073	.147	-.194	**.531**
I feel personally obliged to bear global climate change in mind in my daily behaviour	400	-.005	-.238	.045	.035	-.102	**.632**
I would not feel morally obliged to bear fuel efficiency in mind were I to purchase a car	399	-.031	-.051	-.119	.204	-.154	.298
I do feel morally obliged to reduce my greenhouse gas emissions, regardless of what others do	400	.026	-.188	-.046	.071	-.072	**.602**
I feel personally obliged to reduce my greenhouse gas emissions as much as possible	395	-.011	-.124	-.028	.102	-.148	**.678**
I do feel morally obliged to use public transport whenever I can	400	.139	-.018	-.075	.099	.118	**.519**

Table 22: Structure matrix of variables to measure six constructs from the VBN theory

Variables	n	Component					
		Alt	Bio	Ego	AC	AR	PN
Equality (*equal opportunity for all)*	403	**.671**	-.349	.024	.134	-.047	.213
A World at Peace (*free of war and conflict)*	402	**.668**	-.575	-.059	.196	.162	.187
Social Justice (*correcting injustice, care for the weak)*	404	**.733**	-.424	-.037	.107	-.157	.194
Helpful (*working for the welfare of others)*	405	**.784**	-.262	.129	.096	.049	.168
Respecting the Earth (*harmony with other species)*	401	.314	**-.837**	.018	.255	-.094	.326
Unity with Nature (*fitting into nature)*	400	.200	**-.867**	.057	.182	-.029	.264
Protecting the Environment (*preserving nature)*	402	.327	**-.869**	.076	.325	-.189	.318
Preventing Pollution (*protection of natural resources)*	402	.336	**-.810**	.153	.285	-.113	.349
Social Power (*control over others, dominance)*	400	-.216	-.115	**.620**	-.306	.249	.032
Wealth (*material possessions, money)*	404	-.203	.039	**.716**	-.083	.021	-.216
Authority (*the right to lead or command)*	399	.003	-.088	**.823**	-.203	.028	-.042
Influential (*having an impact on people and events)*	401	.419	-.190	**.643**	.004	.025	.049
Ambitious (*hardworking, aspiring)*	404	.407	-.018	**.637**	.020	.064	-.026
Burning fossil fuels does not contribute to global climate change	385	-.022	-.185	-.124	**.602**	-.423	.192
Environmental quality will improve if we emit less greenhouse gases	382	.067	-.279	-.100	**.698**	-.138	.391
Global climate change is a problem for society	394	.071	-.274	-.040	**.691**	-.159	.581
Reducing greenhouse gas emissions helps to reduce the effects of global climate change	378	.139	-.328	-.083	**.802**	-.221	.514
It is not certain whether greenhouse gas emissions cause global climate change	369	.191	-.195	-.123	**.765**	-.263	.382
Global climate change causes extreme weather events such as flooding or droughts	347	.142	-.264	-.061	**.672**	.021	.523
Because my personal contribution is very small I do not feel responsible for global climate change	398	.131	-.244	-.049	.340	**-.636**	.608
I do not feel personally responsible for my emissions of greenhouse gases	401	.107	-.164	-.108	.364	**-.652**	.451
I feel personally responsible for my contribution towards the global climate change problem	395	.145	-.244	-.133	.424	-.379	.801
The government and industry are responsible for greenhouse gas emissions, not me	394	.077	-.016	-.065	.138	**-.674**	.392
I feel jointly responsible for worldwide greenhouse gas emissions	390	.098	-.154	-.054	.379	-.356	.703
Individuals on their own cannot contribute to the reduction of greenhouse gas emissions	394	-.025	-.249	.003	.311	**-.702**	.324
People like me should do everything they can to reduce their greenhouse gas emissions	399	.073	-.289	.012	.426	-.387	**.664**
I feel personally obliged to bear global climate change in mind in my daily behaviour	400	.162	-.461	.012	.386	-.313	**.751**
I would not feel morally obliged to bear fuel efficiency in mind were I to purchase a car	399	.048	-.195	-.172	.394	-.304	.450
I do feel morally obliged to reduce my greenhouse gas emissions, regardless of what others do	400	.175	-.411	-.082	.404	-.286	**.721**
I feel personally obliged to reduce my greenhouse gas emissions as much as possible	395	.136	-.376	-.084	.463	-.385	**.806**
I do feel morally obliged to use public transport whenever I can	400	.231	-.236	-.102	.324	-.067	**.557**

5.4.3 Correlation between constructs

In the PCA, oblique rotation was chosen over orthogonal rotation as it was assumed that correlation between constructs was probable, as is often the case in psychology (Field, 2009). To test this assumption, and to test for multi-collinearity, Pearson's '*r*', a type of bivariate correlation was used to assess the relationship between pairs of constructs. Pearson's '*r*' returns a value between -1 and 1, with -1 representing a strong negative relationship, 1 representing a strong positive relationship and zero representing no relationship. Whilst a certain amount of correlation was expected between constructs, a high correlation (*r* >. 8) would indicate multicollinearity (Field, 2009).

Table 23 provides information about the correlation among the six components from the VBN theory. Values above the diagonal show correlation coefficients (*r*) between pairs of constructs, with values below the diagonal showing sample size (*N*). Values are also assessed to their level of significance.

Table 23: Bivariate relationships between pairs of constructs

	Alt	Bio	Ego	AC	AR	PN
Alt		.457**	.126*	.183**	.161**	.313**
Bio	405		.131**	.383**	.261**	.491**
Ego	405	405		-.151**	-.099*	-.061
AC	403	403	403		.475**	.650**
AR	403	403	403	403		.591**
PN	402	402	402	402	402	

* Relationship significant at the *p* <.05 level; ** relationship significant at the *p* < .01 level

The presence of statistically significant correlations between constructs suggests that oblique rotation in PCA was an appropriate choice. Cohen (1988) states that a correlation coefficient of .5 indicates a 'large' relationship between two variables. Five pairs of variables have a correlation coefficient of around .5 (Alt/Bio, Bio/PN, AC/AR, AC/PN and AR/PN), 12 of the 15 coefficients are significant at the 1 per cent level, with two of the remaining three relationships significant at the 5 per cent level. Despite the 'large' and significant

relationships, none of the correlations are >.8 that Field (2009) suggests would raise concerns of multi-collinearity.

5.4.4 Construct reliability

To assess the reliability of the constructs that have been created by the PCA, a measure of the consistency of individuals answers to variables within a component is required. A reliable scale should ensure that a participant whom answers a set of items at two points in time, all things being equal, should score the same on both occasions; or that two participants with similar viewpoints should score similarly if both answered the questionnaire (Field, 2009).

Cronbach's alpha, α, is the standard measure of reliability, and is calculated by separating an individual's responses to variables within a construct in half, and comparing the correlation between the two (Field, 2009). This operation is repeated until an individual's responses are split into two halves in every possible way, and it is the mean average of the correlations that is reported in Cronbach's alpha (Field, 2009). Table 24 shows the Cronbach's alpha scores for each of the six components analysed in the PCA.

Scores of α place values >.9 as excellent, >.8 as good, and >.7 as acceptable (George and Mallery, 2003). Across the six constructs, all scores of α are >.7, with biospheric values, AC and PN scores >.8. The inter-item correlation column shows the mean correlation score across sets of pairs of variables within each construct. Inter-item correlation scores of >.3 for a pair of variables within a construct are deemed acceptable (Field, 2009), and for this data set, all correlation scores are deemed acceptable.

The number of items used to measure a construct has an effect on Cronbach's α. Due to the way that Cronbach's α is calculated, the more variables that are used to measure a construct, the higher the score that will be calculated (all else being equal). Cortina (1993) recommends that no more than 14 items should be used in a reliability test. For the six constructs in this study, the

number of items is few, ≤ 6, thus making Cronbach's α an appropriate test. The reliability of the NEP scale is not calculated as it has greater than 14 items.

Table 24: Reliability analysis for six constructs

	N items	*N* responses	Inter-Item Correlation	α
Altruistic Values	4	399	.429	.748
Biospheric Values	4	390	.669	.888
Egoistic Values	5	390	.353	.732
AC	6	311	.447	.820
AR	4	382	.409	.731
PN	5	387	.475	.807

Table 25 shows the descriptive statistics for each of the six constructs that have been created, as well as for the NEP construct. The skewness and kurtosis statistics are shown to describe the shape of the distribution for each construct, to allow evaluation of the normality of the distributions. According to Bulmer (1979), skewness scores above +1 or below -1 are highly skewed, scores between -1 and -0.5 or 0.5 and 1 are moderately skewed, and scores between -0.5 and 0.5 are approximately symmetrical. Kurtosis scores are considered mesokurtic (normal) if they are between -3 and 3 (Bulmer, 1979). Scores above 3 are considered leptokurtic and are displayed as tall narrow distributions; scores below -3 considered platykurtic, and are short in height and broad in width. Due to the large sample size (>200) (Field, 2009) and small standard error rates, Z-score probabilities are not calculated, as the probability of a significant result would be high (Field, 2009). For all of the constructs in this study, skewness and kurtosis scores are between the acceptable limits as defined by Bulmer (1979).

Table 25: Descriptive statistics for the seven constructs in the value-belief-norm theory

	N	Mean	Std.Dev	Skewness	Kurtosis
Altruistic Values	405	5.26	1.15	-0.87	0.63
Biospheric Values	405	4.63	1.41	-0.49	-0.45
Egoistic Values	405	2.67	1.23	-0.09	-0.15
NEP	396	3.50	0.48	-0.19	0.09
AC	403	3.90	0.62	-0.79	1.37
AR	403	3.58	0.69	-0.80	0.46
PN	402	3.63	0.68	-0.71	0.76

Note: Individuals are only excluded from descriptive statistics analysis if they have not answered any of the variables included in each of the constructs (pairwise deletion).

The acceptable skewness and kurtosis scores for all seven variables allow for the constructs to be treated as normally distributed. For the NEP and egoistic values constructs, the distributions most closely match what is considered to be 'normal' – i.e. they are very close to zero. Mean scores for altruistic (5.26) and biospheric values (4.63), are towards the 'very important' end of the response scale, whereas the mean score for the egoistic values is low (2.67), towards the 'not important' end of the scale. Standard deviations across the three values are similar. For the other NEP, AC, AR and PN constructs in the VBN theory, the mean scores are all between 3.5 and 4, indicating a moderate 'acceptance' of the constructs. Standard deviations are also similar, all between 0.45 and 0.70.

5.5 Are there relationships between the acceptability of the seven policy proposals?

Seven policy proposals were included in the study. The first asked the participants to what level they accepted that DMU should reduce its greenhouse gas emissions, and the second about DMU receiving less capital funding from HEFCE if they did not. The remaining five policies proposed hypothetical initiatives that DMU could introduce to reduce its greenhouse gas emissions. These five policy proposals were designed with recommendations from practitioners with responsibilities for DMU's greenhouse gas emissions. The first of the five proposals related to international student recruitment, and sought to test the judgements of employees when financial concerns were directly challenged by environmental concerns. Two of the remaining four were

considered to be ‘pull’ measures – working from home and assistance with train ticket costs. The remaining two were considered to be ‘push’ measures – doubling the price of a car parking permit and reducing the heating set point temperature.

Table 26 shows descriptive statistics for each of the seven policy proposals. A five-point Likert scale was used, from ‘strongly disagree’ to ‘strongly agree’, centred on ‘neither agree nor disagree’, with an additional option ‘don’t know’ (recorded as blank, as with missing responses). Mean scores across the seven policy proposals ranged from a low of 2.15 to a high of 4.36; all have a standard deviation of between 1 and 1.5.

Table 26: Descriptive statistics for each of the seven policy proposals

Dependent Variable	*N*	Mean	St. Dev
Reduce GHG Emissions	396	4.36	1.10
Less Funding	388	3.26	1.31
International Students	381	2.15	1.12
Working from Home	398	4.24	1.04
Parking Permit	380	2.80	1.44
Temperature	395	3.93	1.27
Train Ticket	392	4.02	1.20

The proposal for DMU to reduce its greenhouse gas emissions was found to be the most acceptable, followed by both of the proposals that were considered to be ‘pull’ measures – working from home and assistance with train ticket costs. The proposal to double the price of a car-parking permit divided opinion – the mean score is very close to the mid-point of the scale, and the standard deviation is higher than any of the other proposals. The other ‘push’ measure – to reduce the heating set point - was found to be acceptable, with a mean score of almost 4. The least acceptable proposal was to reduce the number of international students, suggesting that environmental concerns are of less importance than financial concerns. The HEFCE proposal for universities to receive less funding if they did not reduce their greenhouse gas emissions also

divided opinion, with a mean score close to the mid-point of the scale, and the second highest standard deviation.

5.5.1 Data reduction

Although it was not intended that the seven policy proposals would be grouped into components, it is worth exploring the relationships between them to understand the dimensionality. The seven policy proposals were analysed using the same techniques that were used to understand the dimensionality of the variables in the VBN theory. Figure 17 shows the scree plot for components in the policy proposals, with the point of inflexion at the second component, suggesting a two-component solution. The two-component solution explained 46.96 per cent of the variance in the variables. The third component did not meet Kaiser's criterion (eigenvalue of .899) but did explain an additional 12.84 per cent of the variance. Missing data were dealt with by using pairwise deletion. The Kaiser-Meyer-Olkin measure of sampling adequacy - the ratio of squared correlation between variables to squared partial correlation between variables (Field, 2009) - returned a value of .737. Scores above 0.6 are accepted. Bartlett's test of sphericity is rejected (*p* .000) allowing data reduction techniques. To produce the pattern matrix, 10 iterations were required.

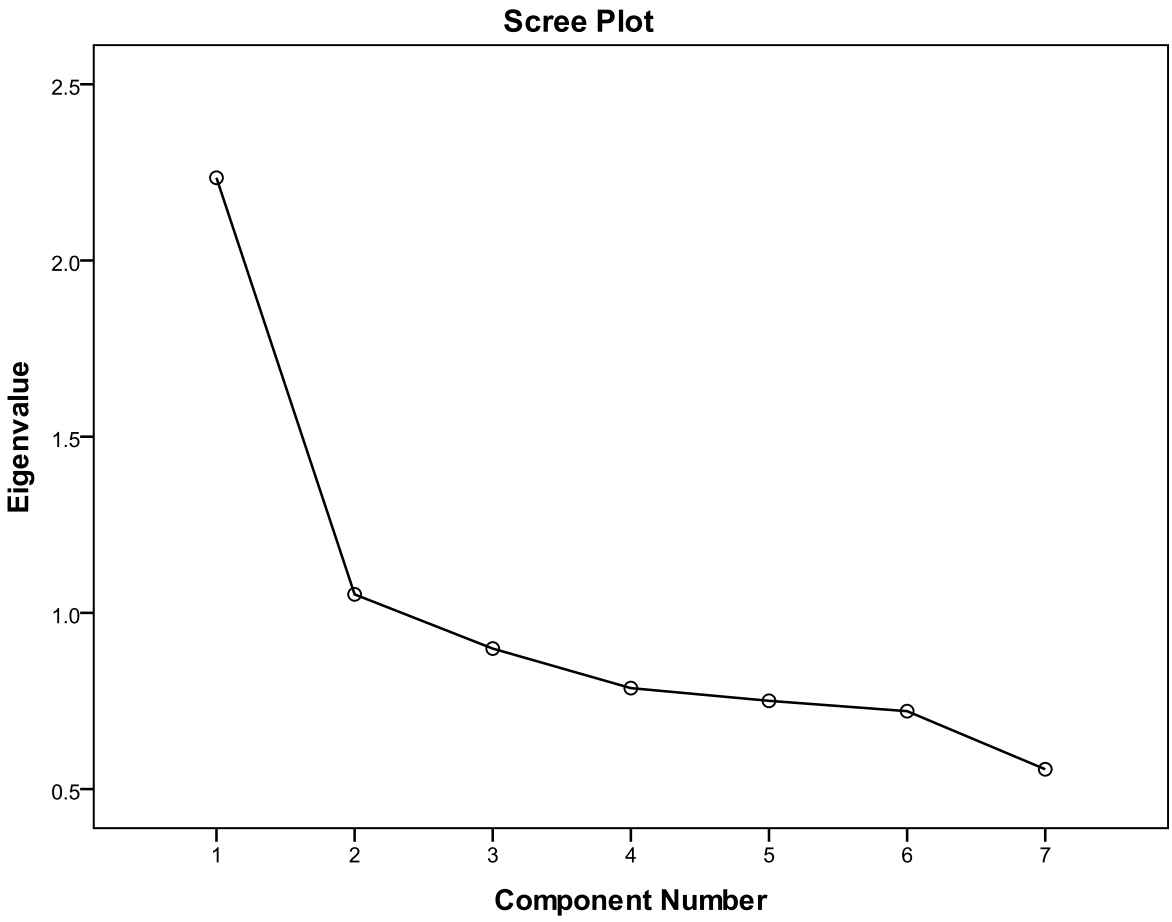

Figure 17: A scree plot of the components found in the policy proposals

Table 27 and Table 28 show the pattern and structure matrices for the loading scores for the policy proposals. Highlighted in bold font are the highest loadings for each variable.

Table 27: Pattern matrix showing loading scores for the policy proposals

Pattern Matrix			
		Component	
	N	1	2
DMU reduce GHG emissions	396	**.654**	.103
Work from home	398	**.726**	-.117
Reduce heating temp	395	**.389**	.316
Train tickets	392	**.672**	-.019
DMU reduced funding	388	.290	**.590**
Reduce int'l students	381	-.294	**.836**
Increase parking charges	380	.223	**.515**

Table 28: Structure matrix showing loading scores for the policy proposals

Structure Matrix			
		Component	
	N	1	2
DMU reduce GHG emissions	396	**.682**	.280
Work from home	398	**.694**	.079
Reduce heating temp	395	**.474**	.422
Train tickets	392	**.667**	.163
DMU reduced funding	388	.450	**.669**
Reduce int'l students	381	-.068	**.756**
Increase parking charges	380	.362	**.575**

Although the PCA has found two distinct components in the group of policy proposals, it is unclear whether the items coherently represent underlying latent constructs. The first group contains two ‘pull’ items – working from home and assistance with payments for train tickets, and one ‘push’ item - reduced heating temperatures. The second component contains one ‘push’ item and two financial items, that may all be perceived to be negative in their consequences for the individual – reduced funding for DMU, reduced number of international students and increased parking charges. The following section details the results of the reliability analyses for the two components identified.

5.5.2 Reliability

Table 29 shows the results of the Cronbach's α reliability test for the seven policy proposals and the seven separated into two components according to the results of the PCA. Also included is an analysis of six of the seven policy proposals, removing the proposal that asked about international student recruitment. This was omitted after initial reliability analyses of all seven policy proposals indicated that the reliability would increase, if the proposal were omitted. The same standards for assessing reliability scores (acceptable scores are above 0.7) that were used for assessing VBN data (George and Mallery, 2003) are used here.

Table 29: Reliability analysis for varying formations of the policy proposals

N items	*N* responses	Inter-item Correlation	α
7	344	.189	.619
6	352	.232	.639
4	374	.243	.556
3	356	.209	.442

The seven policy proposals should not be treated as measuring one item due to a low Cronbach's α score of .619. Removing the proposal regarding international student recruitment increased the α score only marginally, to .639. Dividing the seven proposals into two components, according to the results of the PCA, also results in unacceptable scores of .556 for the first component and .442 for the second. This may be due to the small number of items in each component (Field, 2009). In addition to the poor scores for Cronbach's α, inter-item correlation scores are also unacceptable for all four combinations of the seven variables; in all instances the minimum standard of .3 was not met.

Due to low reliability scores that do not meet the minimum accepted standard, indicating that the seven policy proposals do not relate strongly with each other, the seven policy proposals will be analysed separately in the remainder of the analysis in this thesis.

5.6 Do the constructs in the value-belief-norm theory explain variance in the acceptability of policies?

The factor and reliability analyses produced a VBN theory with all of the *a-priori* intended constructs present, and 43 of the original 46 independent variables remaining. Three variables, two intended to measure ascription of responsibilities and one intended to measure personal norms, were excluded as a result of the PCA, that suggested that these three items did not correlate with the other items in the construct for which they were intended to measure. The policy proposals will be used in the regression as seven separate items.

The regression analysis conducted here follows that of Steg *et al.* (2005) where the full VBN theory was used to understand policy acceptability. Bivariate regression analysis is used to assess the explanatory power of the PN construct to predict variance in the policy proposals. This is followed by multiple regression analyses, where the remainder of the VBN constructs are included in a regression model, also to predict variance in the policy proposals. For the VBN theory to operate as expected, the PN construct should explain more of the variance in the policy proposals than any of the other VBN constructs.

Table 30 shows the results of bivariate and multivariate regression models, for each of the seven policy proposals. In each section of the table, 'model 1' refers to the bivariate analyses, where the PN construct alone predicts variance in the policy proposals. Below the results for 'model 1' in each section of the table, is the results for 'model 2'. Model 2 is a multivariate regression model, where in addition to the PN construct, all of the other VBN constructs are used to explain variance in the policy proposals.

Highlighted in bold throughout are significant *p*-values (where $p < .05$). Reported are standardised β coefficients (the unit change in the standard deviation of the outcome variable attributed to the predictor variable), 95 per cent confidence intervals (if zero occurs between the confidence intervals the predictor variable is no better than the mean in predicting the outcome variable). The 't-statistic' tests the null hypothesis that the β coefficient is zero; the

associated *p*-value gives the probability of obtaining such a value for the 't-statistic' with the stated degrees of freedom (Field, 2009). The adjusted R^2 gives the proportion of variance in the outcome variable that is explained by the predictor variable(s). '*F*' is a ratio of how much the theory has improved prediction of the outcome variable, compared with the level of inaccuracy in the theory. The associated *p*-value gives the probability of obtaining the '*F*' score, if the null hypothesis that the theory does not improve prediction of the outcome is true. Also reported is Cohen's 'f^2', a measure of effect size, calculated by dividing the adjusted R^2 by one minus the adjusted R^2. Effect sizes (f^2) of .01 are small, .09 medium and .25 large (Cohen, 1988).

Table 30: Regression analyses with policy proposals as outcomes

DMU reduce GHG emissions	β	95% CI		*t*	*p*	*Adj* R^2	*F*	*df*	*p*	f^2
Model 1: (*N*=394)						.072	31.69	1, 392	**.000**	0.08
Personal Norms	.273	.286	.594	5.63	**.000**					
Model 2: (*N*=388)						.103	7.33	7, 380	**.000**	0.11
Personal Norms	.110	-.058	.411	1.48	.139					
Ascr. of Resp.	.083	-.057	.323	1.37	.170					
Aware. of Consq.	.235	.175	.654	3.40	**.001**					
NEP	-.046	-.390	.183	-.711	.478					
Altruistic Values	.000	-.103	.103	-.001	.999					
Biospheric Values	-.007	-.104	.093	-.105	.917					
Egoistic Values	-.008	-.097	.082	-.167	.868					

DMU reduced funding	β	95% CI		*t*	*p*	*Adj* R^2	*F*	*df*	*p*	f^2
Model 1: (*N*=386)						.194	93.55	1, 384	**.000**	0.24
Personal Norms	.443	.673	1.01	9.67	**.000**					
Model 2: (*N*=379)						.219	16.15	7, 371	**.000**	0.28
Personal Norms	.233	.180	.707	3.30	**.001**					
Ascr. of Resp.	.067	-.087	.343	1.17	.243					
Aware. of Consq.	.152	.050	.591	2.32	**.021**					
NEP	.054	-.176	.467	.889	.375					
Altruistic Values	-.006	-.123	.110	-.113	.910					
Biospheric Values	.086	-.031	.191	1.41	.157					
Egoistic Values	-.050	-.156	.048	-1.04	.298					

Reduce int'l students	β	95% CI		*t*	*p*	*Adj* R^2	*F*	*df*	*p*	f^2
Model 1: (*N*=379)						.038	15.85	1, 377	**.000**	0.04
Personal Norms	.201	.166	.489	3.98	**.000**					
Model 2: (*N*=372)						.048	3.69	7, 364	**.001**	0.05
Personal Norms	.220	.106	.617	2.78	**.006**					
Ascr. of Resp.	-.089	-.347	.059	-1.39	.163					
Aware. of Consq.	-.060	-.366	.150	-.821	.412					
NEP	.133	-.004	.623	1.94	.053					
Altruistic Values	-.043	-.152	.067	-.759	.449					
Biospheric Values	.021	-.088	.122	.313	.755					
Egoistic Values	-.068	-.159	.034	-1.28	.201					

Work from home	β	95% CI		*t*	*p*	*Adj* R^2	*F*	*df*	*p*	f^2
Model 1: (*N*=396)						.016	7.24	1, 394	**.007**	0.02
Personal Norms	.134	.055	.352	2.69	**.007**					
Model 2: (*N*=389)						.028	2.62	7, 388	**.012**	0.03
Personal Norms	.030	-.186	.277	.386	.700					
Ascr. of Resp.	.123	.000	.372	1.96	**.050**					
Aware. of Consq.	.086	-.093	.379	1.19	.234					
NEP	-.013	-.308	.254	-.187	.851					
Altruistic Values	.056	-.050	.152	.986	.325					
Biospheric Values	-.066	-.145	.048	-.984	.326					
Egoistic Values	-.064	-.142	.034	-1.21	.226					

Increase parking charges	β	95% CI		*T*	*p*	*Adj* R^2	*F*	*df*	*p*	f^2
Model 1: (*N*=378)						.062	26.05	1, 376	**.000**	0.07
Personal Norms	.255	.323	.727	5.10	**.000**					
Model 2: (*N*=371)						.094	6.47	7, 363	**.000**	0.10
Personal Norms	.117	-.073	.559	1.51	.131					
Ascr. of Resp.	.065	-.119	.391	1.04	.297					
Aware. of Consq.	.145	.013	.658	2.04	.041					
NEP	.066	-.192	.580	.989	.323					
Altruistic Values	-.058	-.211	.067	-1.02	.307					
Biospheric Values	-.038	-.173	.095	-.567	.571					
Egoistic Values	-.095	-.233	.010	-1.80	.071					

Reduce heating temp	β	95% CI		*T*	*p*	*Adj* R^2	*F*	*df*	*p*	f^2
Model 1: (*N*=393)						.054	23.37	1, 391	**.000**	0.06
Personal Norms	.237	.262	.620	4.83	**.000**					
Model 2: (*N*=386)						.051	3.959	7, 378	**.000**	0.05
Personal Norms	.195	.081	.634	2.54	.012					
Ascr. of Resp.	.053	-.126	.318	.848	.397					
Aware. of Consq.	-.052	-.386	.175	-.737	.462					
NEP	.075	-.143	.531	1.13	.259					
Altruistic Values	-.028	-.149	.093	-.452	.651					
Biospheric Values	.019	-.099	.132	.286	.775					
Egoistic Values	-.072	-.178	.031	-1.37	.170					

Train tickets	β	95% CI		*T*	*p*	*Adj* R^2	*F*	*df*	*p*	f^2
Model 1: (*N*=390)						.017	7.92	1, 388	**.005**	0.02
Personal Norms	.141	.075	.421	2.81	**.005**					
Model 2: (*N*=383)						.038	3.127	7, 375	**.003**	0.04
Personal Norms	.016	-.241	.299	.209	.835					
Ascr. of Resp.	-.008	-.230	.203	-.120	.904					
Aware. of Consq.	.207	.125	.675	2.86	.004					
NEP	.010	-.302	.350	.146	.884					
Altruistic Values	.093	-.019	.215	1.64	.102					
Biospheric Values	-.123	-.216	.007	-1.84	.066					
Egoistic Values	-.054	-.156	.049	-1.01	.309					

Aside from the second policy proposal (DMU receiving a reduced level of funding) Table 30 shows that only a small amount of the variance (maximum of 7.2 per cent) in the policy proposals has been explained by the personal norms construct. The amount of variance explained increased by only a small amount (to a maximum of 10.3 per cent) when preceding variables in the VBN theory were included in the analysis. For the second policy proposal the adjusted R^2 value is .194, and increases to .219 with the addition of the remainder of the VBN theory. The reasons for these regression analyses results are discussed further in 0. The message from the regression analyses is that, on the whole, the VBN theory and PN construct has helped only to explain a small amount of the variance in the responses to the seven policy proposals used in this study.

5.7 Are the constructs in the value-belief-norm theory related to each other?

Stern *et al.* (1999) postulated that the variables in the VBN theory are linked causally, with each variable (from right to left) being predicted by the preceding variable. To analyse the causal chain nature of the variables in the VBN theory, regression and mediation analysis are used.

5.7.1 Regression analysis

Similarly to section 5.6, bivariate and multivariate regression analyses are used to assess relationships between constructs. For each pair of adjacent constructs in the VBN theory, bivariate regression analyses are calculated. Multivariate regression analysis includes all of the other variables from the VBN theory that precede the dependent variable in the causal chain, from right to left. For example, to understand variance in the PN construct, AR will be used as an independent variable in bivariate regression analyses. This simple model is enhanced by the addition of the remainder of the VBN constructs (AC, NEP, values) in a multiple regression analysis. It is postulated (Stern *et al*., 1999) that for the causal chain in the VBN theory to operate as expected, the variable included as predictor in the bivariate regression should explain more of the variance in the dependent variable, than when additional variables are included in a multiple regression.

Table 31 shows results from bivariate and multivariate regression analyses. In each section of the table, 'model 1' refers to the bivariate analyses between an adjacent pair of variables, and 'model 2' refers to the multiple variable regression analyses where additional predictors were included. In the final part of the table, where altruistic, biospheric and egoistic values are predicting variance in the NEP, there is no 'model 2', as there are no further constructs to 'add-in' to the model.

Table 31: Regression analyses with constructs from the VBN theory as outcomes

	β	95% CI	*T*	*p*	*Adj* R^2	*F*	*df*	*p*	f^2

Personal Norms

Model 1: (*N*=402)						.348	215.1	1, 400	**.000**	0.53
Ascr. of Resp.	.591	.503	.659	14.6	**.000**					
Model 2: (*N*=395)						.579	91.28	6, 388	**.000**	1.38
Ascr. of Resp.	.321	.247	.394	8.54	**.000**					
Aware. of Consq.	.350	.292	.479	8.09	**.000**					
NEP	.110	.034	.275	2.52	**.012**					
Altruistic Values	.103	.018	.105	2.80	**.005**					
Biospheric Values	.172	.042	.123	3.99	**.000**					
Egoistic Values	.005	-.035	.041	.145	.885					

Ascr. of Resp.	β	95% CI		*T*	*p*	*Adj* R^2	*F*	*df*	*p*	f^2
Model 1: (*N*=403)						.224	117.06	1, 401	**.000**	0.29
Aware. of Consq.	.475	.436	.630	10.8	**.000**					
Model 2: (*N*=395)						.235	26.26	5, 389	**.000**	0.31
Aware. of Consq.	.420	.347	.582	7.74	**.000**					
NEP	.046	-.098	.228	.787	.432					
Altruistic Values	.048	-.030	.087	.971	.332					
Biospheric Values	.057	-.027	.083	.992	.322					
Egoistic Values	-.049	-.078	.024	-1.04	.297					

Aware. of Consq.	β	95% CI		*t*	*p*	*Adj* R^2	*F*	*df*	*p*	f^2
Model 1: (*N*=395)						.313	180.65	1, 393	**.000**	0.46
NEP	.561	.612	.822	13.4	**.000**					
Model 2: (*N*=395)						.333	50.199	4, 390	**.000**	0.50
NEP	.470	.477	.724	9.54	**.000**					
Altruistic Values	.060	-.017	.082	1.29	.195					
Biospheric Values	.130	.011	.103	2.43	**.015**					
Egoistic Values	-.103	-.095	-.009	-2.39	**.017**					

NEP	β	95% CI		*T*	*p*	*Adj* R^2	*F*	*df*	*p*	f^2
Model 1: (*N*=396)						.297	56.60	3, 392	**.000**	0.42
Altruistic Values	-.067	-.068	.011	-1.41	.158					
Biospheric Values	.553	.157	.221	11.67	**.000**					
Egoistic Values	-.233	-.125	-.059	-5.46	**.000**					

Table 31 shows a good amount of the variance in VBN constructs explained by preceding constructs in the VBN theory. Table 31 shows 34.8 per cent of the variance in the PN construct to be explained by AR (β .591, t = 14.6, *p* .000; *F* 215.1, *p* .000; f^2 0.53). Explained variance increases to 57.9 per cent (*F* 91.28, *p* .000; f^2 1.38) when the remaining constructs in the VBN theory are included. The high proportion of variance explained is similar to that reported in Steg *et al.* (2005) – explained variance was 32 per cent and 49 per cent respectively. The effect sizes (f^2) are also quite large for both, as was the case in Steg *et al.* (2005).

For the next stage 'back' - right to left - across the theory, AC explained 22.4 per cent (β .224, *t* = 10.8, *p* .000; *F* 117.06, *p* .000; f^2 0.29) of the variance in AR responses, increasing to 23.5 per cent (*F* 26.26, *p* .000; f^2 0.31) upon the addition of the remaining constructs. The NEP predicted 31.3 per cent (β .313, *t* = 13.4, *p* .000; *F* = 180.65, p.000; f^2 0.46) of the variance in AC, increasing to 33.3 per cent (*F* = 50.19, *p.*000; f^2 0.50) upon the addition of the remaining constructs.

The three value orientations collectively explain 29.7 per cent of the variance in NEP scores (*F* = 56.60, *p*.000*;* f^2 0.42). Each of the three values contributed in different ways, but as expected, to the variance in NEP scores. Biospheric values have a significant *positive* relationship with NEP scores - those who have higher scores on the biospheric values scale score higher on the NEP (β .553, *t* = 11.67, p.000); altruistic values do not have a significant relationship with NEP scores (β -.067, t = -1.41, *p*.158) and egoistic values have a significant *negative* relationship with NEP scores - those who have higher scores for the egoistic values, have lower scores for the NEP (β -.233, *t* = -5.46, p.000). The relationships between values and NEP scores replicate the results of Steg *et al.* (2005).

5.7.2 Mediation analysis

Simple mediation analysis tests the total, direct and indirect effects between two variables, mediated by a third. Figure 18 shows a schematic of the variable layout in simple mediation analysis (IV = independent variable, MV = mediating variable, DV = dependent variable).

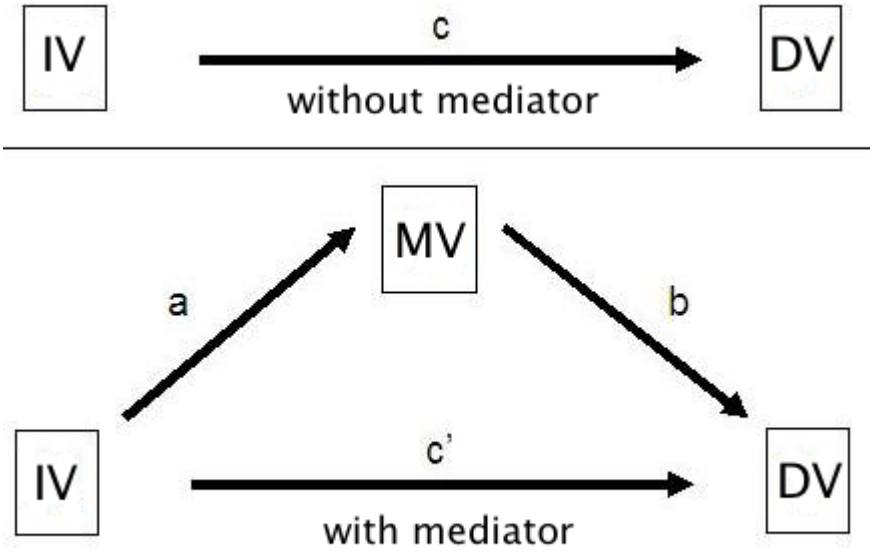

Figure 18: Schematic of the two mediation models

In the mediation schematic, 'c' denotes the *total* predicted change in Y caused by X, c' the *direct* effect of a 1 unit change in X on Y, and *ab* the *indirect* effect of a 1 unit change in X on Y, mediated by M. c is calculated using the following equation:

$$c = c' + ab$$

Techniques for analysis of mediation have moved on from the landmark 1986 causal steps approach by Baron and Kenny (Hayes, 2009). In Baron and Kenny (1986), four rules were prescribed for the testing of mediation. In brief, path coefficients a, b and c must be (individually) significant using the t distribution, and path coefficients for c' must be closer to zero than c. Although this method has been widely used, it has a number of flaws (Hayes, 2009). Firstly, it has

been shown to be low in explanatory power (Fritz and MacKinnon, 2007), thus making detection of significant results less likely, and increasing the chances of a Type II error. Secondly, the effect of the intervening variable, M, is inferred logically based upon hypothesis tests of the paths a and b. The assumption is that if paths a and b are significantly different from zero, the indirect effect must also be significant. Hayes (2009) suggests that these inferences about the indirect effect should be based upon tests of the indirect effect, not the paths to and from the mediator. Hayes (2009) goes on to suggest that it is possible for an indirect effect to be significant, and for one of the paths a or b to not be significant (Type II error).

A commonly used test to quantify the *indirect effect* (*ab*) is the Sobel test. The Sobel test is calculated by assessing the ratio of *ab* to its standard error. The issue with the Sobel test is the assumption that the distribution of the indirect effect, *ab*, will be normal (Hayes, 2009). The distribution of the indirect effect, *ab*, has been shown in the past to not be normal (Bollen & Stine, 1990; Stone & Sobel, 1990).

Developments in the techniques for assessing the indirect effect path coefficients create normal distributions using *bootstrap resampling methods* (Hayes, 2009). Bootstrap resampling methods draw resamples from the original sample data, and then replace the resample. This method is repeated thousands of times, thus creating several thousand sub-samples, which therefore have a normal distribution. From each sub-sample, statistics can be calculated, such as the mean and median, standard deviation, confidence intervals and so on. Thus, thousands of estimates of each statistic are obtained, as opposed to just one.

From each bootstrap resample drawn, an estimate of the path coefficients for a and b, and the product of the two, the indirect effect *ab*, are calculated. A bootstrap sample with 5000 resamples, gives 5000 estimates of the indirect effect ab. Ordering the estimates of the indirect effect *ab* by size, reading the 2.5 and 97.5 percentiles, gives 95 per cent confidence intervals. If zero does not

appear between the lower (2.5) and upper boundaries (97.5) of the confidence limits for the indirect effect, the null hypothesis that the mediator is not having an effect can be rejected, with 95 per cent confidence.

Reported in Table 32 are path coefficients and their associated error rates for each of the four paths shown in Figure 18, for all of the sets of variables in the VBN theory and the policy proposals. Although path coefficients are not used *directly* to assess mediation, it is important to display them to assist in explanation and assessment of the relationships between the variables.

Table 33 shows the indirect effect, *ab*, the associated error rate, and the 95 per cent confidence intervals for the estimate of the indirect effect. Alongside reporting of the indirect effect, is reporting of the effect size, $Kappa^2$ (Kappa squared), for the indirect effect. Again, an associated error rate and 95 per cent confidence intervals are reported for the effect size. Though reserved in their postulation of size of effect for $Kappa^2$, Preacher and Kelly (2011) recommend following the Cohen (1988) suggestions for small (.01), medium (.09) and large (.25) effect sizes.

Table 32: Results of path coefficients from mediation analysis

Path Coefficients					
X	M	Y	Path	β	Std Error
Altruistic	NEP	AC	a	.064	.021
			b	.698	.053
			c'	.050	.022
			c	.095	.026
Biospheric	NEP	AC	a	.168	.015
			b	.634	.060
			c'	.057	.020
			c	.164	.020
Egoistic	NEP	AC	a	-.067	.019
			b	.702	.054
			c'	-.033	.021
			c	-.080	.025
NEP	AC	AR	a	.716	.053
			b	.485	.058
			c'	.111	.075
			c	.459	.067
AC	AR	PN	a	.536	.049
			b	.357	.038
			c'	.526	.043
			c	.718	.042

Path Coefficients (X=AR; M=PN)			
Y	Path	β	Std Error
DMU reduce GHG emissions (DV1)	a	.593	.040
	b	.340	.097
	c'	.166	.096
	c	.367	.078
DMU reduced funding (DV2)	a	.585	.040
	b	.759	.108
	c'	.144	.107
	c	.588	.091
Reduce int'l students (DV3)	a	.579	.040
	b	.421	.102
	c'	-.154	.099
	c	.090	.081
Work from home (DV4)	a	.580	.040
	b	.077	.093
	c'	.210	.091
	c	.254	.074
Increase parking charges (DV5)	a	.592	.041
	b	.394	.128
	c'	.219	.127
	c	.451	.103
Reduce heating temp (DV6)	a	.578	.040
	b	.373	.113
	c'	.113	.110
	c	.329	.090
Train tickets (DV7)	a	.587	.040
	b	.202	.109
	c'	.075	.108
	c	.194	.087

Table 33: Results of product of coefficients and *Kappa*^{2}

Variables			Indirect effect				Kappa^2			
X	M	Y	Mediated effect (ab)	Boot SE	Percentile Boot LLCI	Percentile Boot ULCI	Effect Size	Boot SE	Boot LLCI	Boot ULCI
Altruistic Values	NEP	AC	.045	.015	.015	.076	.091	.030	.032	.150
Biospheric Values	NEP	AC	.107	.015	.077	.139	.235	.029	.180	.292
Egoistic Values	NEP	AC	-.047	.014	-.076	-.020	.103	.029	.046	.159
NEP	AC	AR	.348	.056	.240	.457	.219	.033	.154	.283
AC	AR	PN	.192	.035	.129	.264	.202	.031	.144	.265
AR	PN	DV1	.202	.062	.083	.322	.104	.033	.042	.169
AR	PN	DV2	.444	.068	.310	.577	.201	.030	.141	.261
AR	PN	DV3	.244	.059	.134	.367	.125	.029	.069	.185
AR	PN	DV4	.045	.058	-.068	.162	.025	.024	.002	.090
AR	PN	DV5	.233	.080	.080	.395	.094	.031	.032	.156
AR	PN	DV6	.216	.073	.081	.368	.097	.032	.038	.163
AR	PN	DV7	.119	.080	-.043	.268	.056	.033	.003	.124

In Table 32 and Table 33 results of the path coefficients, product of coefficients and *Kappa*^{2} are shown. For a variable (M) to be determined as mediating the relationship between an independent (X) and dependent variable (Y), the percentile bootstrap confidence intervals for the indirect effect must not 'straddle' zero.

For all of the proposed relationships between constructs in the VBN theory, a mediating effect is found. None of the percentile bootstrap confidence intervals for the indirect effect 'straddle' zero. These results provide further confirmation of the causal chain nature of the relationships between constructs in the VBN theory, and fit with the results from the regression analyses, and the results presented in Steg *et al.* (2005).

When the NEP is used as a mediator between altruistic values and AC, the effect is very small (Kappa^2 .091; CI: .032 to .150). Although the confidence intervals for the indirect effect do not straddle zero, both are almost zero (CI: .015 to .076). When egoistic values is the independent variable, the effect size result is similar (Kappa^2 .103; CI: .046 to .159) and the confidence interval for

the indirect effect is almost, but does not straddle zero (CI: -.076 to -.02). When the NEP is used as a mediator between biospheric values and AC, the effect size is small to medium (Kappa^2 .235; CI: .180 to .292) and the confidence interval for the indirect effect does not straddle zero (CI: .077 to .139). When AC is the mediator of NEP and AR, again the effect size is small to medium (Kappa^2 .219; CI: .154 to .283) and the confidence interval for the indirect effect does not contain zero (.240 to .457). When AR mediates the relationship between AC and PN, the effect size is small to medium (Kappa^2 .202; CI: .144 to .265) and again the confidence interval for the indirect effect does not contain zero (CI: .129 to .264).

When policy proposals are used in the model however, a mediating effect is not always found. For two of the seven policy proposals (DV4 and DV7), percentile bootstrap confidence intervals for the indirect effect 'straddle' zero. In both instances, effect sizes were small (Kappa^2 .025 and .056; CI .002 to .090 and .003 to .124 respectively) but the path coefficient from the independent variable (AR) to the mediator (PN) was strong in both instances (β .580 and .587 respectively), indicating that mediation was not found because of the weak relationship between the mediator and the dependent variable. Given the poor results presented for the regression analysis when predicting variance in the policy proposals, it is unsurprising that a mediating effect is not found.

In all but one instance when PN is mediating the relationship between AR and a policy proposal, the effect size is small. The only instance of a mediating effect greater than small is for the second of the policy proposals (Kappa^2 .201; CI .141 to .261).

When policy proposals 1, 3, 5 and 6 were included in the analysis, the effect size on each occasion was small (Kappa^2 .104, .125, .094 and .097). Though the confidence intervals for the indirect effects did not straddle zero for all four analyses, they were very close to zero at the lower level for policy proposals 1, 5 and 6 (CI .083 to .322; .134 to .367; .080 to .395 and .081 to .368

respectively). Again, path coefficients between the independent variable (AR) and the mediator (PN) are always strong (β .593; .579; .592 and .578).

5.8 Summary of findings against objectives

The findings in this chapter related to objectives 1, 2 and 5 are presented below.

5.8.1 Objective one

The first objective sought to understand attitudinal factors influencing acceptability of policy:

> *To understand attitudinal factors influencing acceptability of greenhouse gas emissions reduction policies, using the value-belief-norm theory*

The VBN theory was identified in Chapter 2 as being a frequently used theory to understand policy acceptability. A combination of bivariate and multivariate linear regression analysis were used to assess the ability of the VBN theory to predict acceptability of seven policy proposals. The hypothesis for this objective was:

> *Individuals with pro-environmental attitudinal perspectives will be more likely to accept policies to reduce greenhouse gas emissions*

The VBN theory had mixed but limited success in its ability to explain acceptability of policy. For the second of the seven policy proposals - for a higher education institution to receive less funding if it fails to reduce its greenhouse gas emissions - the personal norms (PN) construct explained 19.4 per cent of the variance. This increased to 21.9 per cent when other VBN constructs were included in a multiple regression model, with awareness of consequences (AC) being the only additional significant predictor in the model.

Explaining ~20 per cent of the variance in one of the policy proposals gives the initial impression that the VBN theory was a successful predictor in this study. It

is comparable to the 29 per cent that the VBN theory explained in Steg *et al.* (2005).

However, for the other six policy proposals, the personal norms construct failed to explain more than 8 per cent of the variance in policy acceptability. When the enhanced multivariate model was used, including all of the VBN constructs, this increased to a maximum of 10.3 per cent. For two of these six policy proposals, the PN construct explained less than 2 per cent of the variance. For these six policy proposals, the standardised beta coefficients (β) were less than .3. The findings against these six policy proposals indicated that the VBN theory has not, in this study, provided a successful explanation of policy acceptability.

5.8.2 Objective two

The second objective concerned the characteristics of the social networks at a higher education institution:

> *To explore employee social networks within a higher education institution*

For this objective, no hypothesis was offered as studies of social networks at higher education institutions had not been published in the past. To collect social network data, participants were asked to name colleagues with whom they felt 'very close'. Three prompts were offered to participants to provide clarity:

- Colleagues with whom the participant regularly kept in touch with
- Colleagues with whom the participant discussed important matters with
- Colleagues who were there for the participant when they needed help

Participants were also asked about their perception of the same connection between the colleagues that they named - so called alter-alter (or colleague-colleague) connections. Networks were found to vary in size between one person (i.e. just the participant) and 27 people (the participant and 26 colleagues), with the mean network size (rounded up) to be 8 people.

The proportion of connections present in a network ranged from zero (no connections) to one (all connections present), with a mean of .535. The size and proportion of connections present, for each of the 88 networks was used to make typologies of networks. These data were used in a cluster analysis; a solution that separated the 88 networks into six groups was found to be the most appropriate. In the first of the six groups, a cluster of four networks were found – these had a large number of colleagues and a low proportion of ties present between the colleagues. The second cluster included three networks, again with a large number of colleagues but with an average number of connections between the colleagues. In the third cluster, 48 networks were grouped together – over half of all networks in this study. These networks were found to have an average (mean) number of colleagues in them and an average number of connections between the colleagues. Cluster four contained 17 small networks, with a high proportion of connections present between the colleagues. In cluster five, 11 small networks were found, and for each network every possible connection between colleagues was realised. The final cluster contained five networks, each with only one person in them.

5.8.3 Objective five

The fifth objective of this study was:

> *To test the full value-belief-norm theory*

This objective was selected because in many of the studies where the VBN theory was used to understand policy acceptability very rarely was the full and unaltered VBN theory operationalized. Typically, constructs were added in, removed or replaced. This objective was included to add to the cumulative understanding of the VBN theory's use for predicting policy acceptability. The hypothesis reflected the findings from an earlier study where the full VBN theory was used (e.g. Steg *et al.*, 2005):

> *The expectation is that variables in the theory are significantly predicted by preceding variables in the theory, and less so by variables 'further*

back' in the theory. The VBN theory will also be tested for mediation, with the expectation that a variable sufficiently mediates the relationship between variables immediately preceding and following it

Bivariate and multivariate linear regression and mediation analysis were used to assess whether the constructs in the VBN theory were related to each other as anticipated. The method employed in this study for bivariate and multivariate linear regression analysis replicated the method employed by Steg *et al.* (2005) and the bivariate linear regression findings from this study mirrored the findings from that study. Each construct in the VBN theory was significantly predicted by the construct preceding it; explained variance in the four bivariate models in this study ranged from 22 to 34 per cent; in Steg *et al.* (2005) explained variance in the four bivariate models ranged from 21 to 32 per cent.

Multivariate analysis revealed that constructs 'further back' in the VBN theory's causal chain contributed to the prediction of constructs 'further up' in the chain. For example, it was anticipated that ascription of responsibility (AR) would be significantly related to personal norms (PN); in addition, it was found that the awareness of consequences (AC), new environmental paradigm (NEP), altruistic and biospheric values constructs also contributed significantly to the prediction of PN. Steg *et al.* (2005) report instances of additional predictors being significantly related to constructs further up in the VBN causal chain, but typically there are fewer than the number reported in this study. Explained variance from multivariate models in this study is in line with that reported in Steg *et al*. (2005). In this study, multivariate models explained between 23 and 57 per cent of variance; in Steg *et al.* (2005), they explained between 29 and 49 per cent of variance.

Mediation analysis in this study suggested agreement with the causal chain of variables posited by Stern *et al.* (1999) and the results also replicated the findings of Steg *et al.* (2005). The findings from bivariate and multivariate linear regression, and mediation analysis suggest acceptance of the proposed causal

chain of relationships in the VBN theory, in accordance with the hypothesis in this study.

5.9 Chapter summary

This chapter has been separated into five sections, representing the five research questions that were identified in order to meet three of the objectives of this study. A number of statistical techniques have been used to provide a quantitative perspective on each of these research questions; this represents the quantitative approach that was adopted in Chapter 4, to collect data.

For the first of the five research questions, characteristics of employee social networks within a higher education institution were explored. The average network contained ~8 individuals, with approximately half of the connections between individuals in the network being realised. Cluster analysis revealed that there are six types of networks.

Forty-six items were used in the questionnaire to capture the seven constructs that make up the VBN theory. An analysis of the relationships between 31 of these 46 items suggested that they successfully tapped the seven VBN constructs as intended. In regression and mediation analysis, the seven constructs were found to be related to each other as originally proposed by Stern *et al.* (1999) and as tested by Steg *et al.* (2005).

Seven policy proposals were used in the study. The relationships between the seven policy proposals were too weak for them to be treated as measuring a single latent construct. Two components were found within the seven policy proposals, but again the relationships between the items in each component were too weak for each of the components to be treated as a single item.

Regression analyses suggested that the constructs in the VBN theory provided a poor explanation of the variance in the acceptability of the seven policy proposals. Explained variance for one of the seven proposals was ~20 per cent, but for the other six proposals, the VBN theory never explained more than 10

per cent of the variance. The possible reasons for the poor performance of the VBN theory are discussed in more detail in 0.

Chapter 6 Combining social context and attitudinal influences on policy acceptability

The previous results chapter examined the questionnaire and social network data separately. In this chapter the two are brought together. Bringing the two data strands together allows for an understanding of whether networks contain individuals who share similar attitudinal perspectives and policy acceptability. There are three research questions that guide the analysis and results presented in this thesis (sections 6.2 to 6.4).

6.1 Objectives, hypotheses and research questions

This chapter specifically relates to the third and fourth objectives:

Objective 3. *To explore the relationship between attitudinal factors and social networks*

Objective 4. *To explore the relationship between acceptability judgements and social networks*

Each of the objectives has a hypothesis:

Hypothesis 3. Attitudinal factors towards the environment will be similar amongst those who are connected in networks

Hypothesis 4. Individuals who are connected in networks will have similar acceptability of policies to reduce greenhouse gas emissions

There are a number of research questions associated with these objectives:

- Do egos select alters who have similar attitudinal perspectives to themselves? (section 6.2)
- Do egos select alters who accept similar greenhouse gas emissions reduction policies to themselves? (section 6.3)

- In networks that are more closely knit, is there less variability in attitudinal perspectives? (section 6.4)

A description of how these research questions are to be answered is provided in Table 34, along with the name of the statistical tests to be used. The research questions identified here are used as section headings through the rest of this chapter.

Table 34: Research questions addressed in chapter six

Research Question	Question detail	How the Question will be answered	Test
Do egos select alters who have similar attitudinal perspectives to themselves? (6.2)	To understand, in absolute terms, whether egos selected alters who have the same attitudinal perspectives as themselves, using attitudinal information gathered with the VBN theory.	The E-I index is used; it assesses the number of ties that ego has to alters who are either internal or external. Internal ties are to alters who have the same characteristic as ego, whereas external ties are to alters who have a different characteristic. E-I index scores are between -1 and +1. A score of -1 indicates perfect homophily; i.e. that all of ego's ties are to alters who have the same characteristic as themself. A score of +1 indicates perfect heterophily; i.e. that all of ego's ties are to alters who do not have the same characteristic as themself.	E-I Index
	To understand, in relative terms, whether egos selected alters as part of their network who are more similar to themselves than a randomly selected alter, using attitudinal information gathered with the VBN theory.	An ego's average score for a VBN construct will be compared to the average score of the alters in their network and the average score of all alters, to see whether the difference between ego and their alters is smaller than the difference between ego and all alters.	T-Test
Do egos select alters who accept similar GHG emission reduction policies to themselves? (6.3)	To understand, in absolute terms, whether egos select alters who accept the same policies and measures to reduce DMU's greenhouse gas emissions as themselves.	The E-I index is used; it assesses the number of ties that ego has to alters who are either internal or external. Internal ties are to alters who have the same characteristic as ego, whereas external ties are to alters who have a different characteristic. E-I index scores are between -1 and +1. A score of -1 indicates perfect homophily and that all of egos ties are to alters who have the same characteristic as themself. A score of +1 indicates perfect heterophily and that all of egos ties are to alters who do not have the same characteristic as themself.	E-I Index
	To understand, in relative terms, whether egos select alters as part of their network who are more similar to themselves than a randomly selected alter, in their acceptance of policies and measures to reduce DMU's greenhouse gas emissions.	An ego's score for acceptability of a policy proposal will be compared to the average score of the alters in their network, and the average score of all alters to see whether the difference between ego and their alters is smaller than the difference between ego and all alters.	T-Test
In networks that are more closely knit, is there less variability in attitudinal perspectives? (6.4)	To understand whether variability in responses to VBN construct variables is related to the proportion of ties present in a network.	Each network's tie density will be compared with the standard deviation of each networks answers for each of the seven constructs.	Correlation

6.2 Do egos select alters who have similar attitudinal perspectives to themselves?

For the first research question, the data are examined to determine whether egos selected alters who have similar attitudinal perspectives to themselves. Egos selected alters in the data collection exercise (section 4.4) to whom they felt that they were ‘very close’. To assess whether egos selected alters who are similar to themselves, two tests were carried out. The first test uses a technique from social network analysis, the ‘E-I index’, to assess in absolute terms whether ego selected alters who have the same attitudinal perspectives as themself. The second test assesses whether the alters who ego selected are similar to themself, relative to the other alters in the study.

6.2.1 Assessing similarity with the E-I index

To assess in absolute terms the similarity between ego and their alters, a measure developed for use specifically in social network analysis, the E-I index, is used. The E-I (or external-internal) index is the standard measure of homophily, the tendency of individuals to associate with similar others.

The E-I index counts the ties an individual has that are ‘internal’ and compares them with the number that they have that are ‘external’. A tie is classed as internal or external depending on the characteristics of the connected pair of individuals. A tie between two individuals who have the same characteristic is termed an internal tie, and a tie between two individuals who do not have the same characteristic is termed an external tie. To convert a count of internal and external ties into an indexed ‘score’, a calculation was developed by Krackhardt and Stern (1988). ET represents external ties, and IT represents internal ties.

$$E - I\ Index = \frac{ET - IT}{ET\ +\ IT}$$

To demonstrate the E-I index and associated calculation, an example network is shown in Table 35. In the example, gender is the characteristic of interest.

Table 35: Example network

	John	Geoff	Terry	Sally	Vicky	Paula
John		1		1		
Geoff	1			1	1	1
Terry				1		1
Sally	1	1	1		1	
Vicky		1		1		1
Paula		1	1		1	

In the example network, internal ties are either male-to-male, or female-to-female. External ties are either male-to-female/female-to-male. Cells marked with a '1' represent a connection between the individuals in the column/row headings. John has one external connection (to Sally) and one internal connection (to Geoff). Geoff has three external connections (to Sally, Vicky and Paula) and one internal connection (to John); Sally has one internal connection (to Vicky) and three external connections (to John, Geoff and Terry), and so on for the remaining three individuals.

E-I index scores are on a scale between -1 and +1; a score of -1 represents an individual who only has ties to those who share the same characteristic as they have. This is termed 'homophily'. A score of +1 represents an individual who is only connected to those with a different characteristic to themselves. This is termed 'heterophily'. Scores in between -1 and +1 represent the various levels of homophily/heterophily, with the mid-way point, zero, being equally representative of homophily/heterophily. In the example network with gender as the characteristic, John has an E-I score of 0 calculated by first subtracting the number of internal ties from the number of external tie, and dividing by adding the number of external and internal ties (1-1/1+1 = 0) indicating a neutral network. John is connected to an equal number of individuals with the same gender as himself, as he is to individuals with a different gender to himself. Geoff has a score of 0.5 (3-1/3+1 = 0.5) indicating a heterophilous network; and Sally also has an E-I index score of 0.5 (3-1/3+1 = 0.5) also indicating a heterophilous network. Table 36 gives the E-I index for each person in the example network.

Table 36: E-I index scores for example network

ID	E-I Index score	Homo/Heterophilous
John	0	Neutral
Geoff	0.5	Heterophilous
Terry	1	Heterophilous
Sally	0.5	Heterophilous
Vicky	-0.33	Homophilous
Paula	0.33	Heterophilous

In this study, the focus is not on gender, but on various attitudinal characteristics, as measured by constructs in the VBN theory. The measures of attitudinal characteristics in this thesis are on a continuous scale, not categorical, like gender. This is an issue because the calculation for measuring E-I index scores requires characteristics to be exactly the same for a connection to be counted as 'internal'. In this study, VBN construct scores are averaged to two decimal places; scores that are as little as 0.01 apart from each other would therefore be counted as external by the E-I index calculation. The following sections detail the process of rounding of continuous scores to convert them into categorical scores, before they are used in the E-I index calculation.

6.2.2 Categorising continuous data

With the data being continuous and rounded to two decimal places, the data are essentially in four hundred very small 'bins', 0.01 in 'width'. By rounding the continuous data up or down, it can be sorted into a more sensible number of bins, appropriate for assessing similarities and use in the E-I index calculation.

Three options for bin sizes are presented here. Each has their advantages and disadvantages, and each represents the data in a different way accordingly. More bins increases the likeliness of heterophily, and with less bins comes increased likeliness for homophily. The factor determining the decision on the number of bins is that when individuals have similar scores to each other, they are represented as such in the E-I index calculation.

The three options are as follows:

- *Option 1*: Round each mean score to the nearest whole number; use whole numbers as characteristic bins. This creates five or nine bins, based on the response scale used in the questionnaire.
- *Option 2*: Dichotomise the data, using the mid-point of the scale. This creates two bins.
- *Option 3*: Divide the mean responses into three or four bins– three for the NEP, AC, AR, PN constructs (‘agree’ ‘disagree’ ‘unsure’) and four for the values constructs (‘opposed’ ‘not important’ ‘important’ ‘very/supremely important’)

Each of the three options is presented here in more detail, with results displayed by network and by construct. For all three options, only networks where the questionnaire response rate was 100 per cent were included. Of the 88 networks in this study, there are 17 that fit this criterion. Networks with one or more non-responding alter(s) are not included, as in these cases, it is not known whether alter(s) who did not answer the questionnaire would share (or otherwise) characteristics with their ego. An ego’s connection to a non-responding alter is counted as being external.

Option 1: Round each mean score to the nearest whole number; use whole numbers as characteristics

Option one recodes an individuals mean score for a construct from two decimal places, to whole numbers. This directly represents the response scale that the participants used to answer the questionnaire (either a five or nine point Likert

scale). The rationale behind the rounding of the data in this way for option one, is the same that was used to develop the response scales for the questionnaire – the conceptual distance between points is enough to warrant being represented differently. Five bins are created for the constructs that used a five-point Likert response scale, and nine bins are created for the constructs that used a nine-point Likert response scale.

The issue with this method is the resulting level of granularity. For example, for the constructs that used the five-point Likert response scale, five bins are created and each is considered equally different to each other in the E-I index calculation. It treats '4' (represented as 'agree') and '5' (represented as 'strongly agree') as equally different and distant from each other as '5' ('strongly agree') and '1' ('strongly disagree'). Both are represented by the E-I index calculation as an external tie, whereas actually in the first part of the example, both individuals agreed, but one strongly so, and in the second part of the example, the individuals had very different perspectives.

In Option Two, the VBN mean construct scores are dichotomised into agree and disagree, to deal with the problems highlighted by the five-bin option where agree and strongly agree are characterised as being equally different as strongly agree and strongly disagree.

Option 2: Dichotomise the data, using the mid-point of the scale

In this option, the data are dichotomised, using the mid-point of the scale as the dividing point, creating two bins. For the five-point Likert response scale, a mean score above three is transformed into 'agree', and a mean score of three or below is transformed into 'disagree'. For the nine-point Likert scale used for the values section of the questionnaire, scores above three are transformed into important, and scores of three or less are transformed into not important.

This option resolves the issue that was shown in the example in option one, with the five-point Likert response scale; agree and strongly agree are treated as being the same (internal) - strongly disagree and disagree are treated as

being the same (internal), whereas previously they were treated as being different (external).

This option is problematic, however, because it does not properly cater for those who, on average, are ‘unsure’ about a construct. For example, an ego and an alter with mean construct scores of 2.9 and 3.1 respectively would have the tie between them counted as external – even though they both were, on average, unsure about the construct.

Option 3: Three or four bins, allowing for representation of unsure.

In options one and two, the five/nine and two bin options were not appropriate, given how they would result in external ties being created between individuals, that should be treated as internal. Option three seeks to resolve this issue.

For the values constructs in the questionnaire, which used a 9 point response scale, four bins were created in option three ‘opposed to my values’, ‘not important’, ‘important’, and ‘very important’. Individual mean scores for each of the values components were rounded up or down, into one of the four categories, and re-coded. Those with a score <-0.5 are re-coded to ‘opposed to my values’, those with a score, ≥-0.5 and <0.5 are re-coded to ‘not important’, those with a score ≥0.5 and <5.5 are re-coded to ‘important’, those with a score ≥5.5 are re-coded to ‘very important’. For the NEP, AC, AR, and PN constructs, which were answered on a five-point Likert response scale, a three-bin option is presented. Mean scores ≤2.5 are re-coded as ‘disagree’ and mean scores ≥3.5 are re-coded as ‘agree’, with those in-between re-coded as ‘unsure’.

The three bin option used for the NEP, AC, AR and PN constructs is an improvement on both the two and five bin options as it allows for those who, on average, agree or strongly agree to be treated as being the same (internal). The three bin option also allows for those who are, on average, unsure to be differentiated from those who agree or disagree. The four bin option used for the values constructs is an improvement over the nine and two bin options, for these same reasons.

Option three therefore offers the best available solution for re-coding continuous scores into categorical scores. For the remainder of this chapter, in places where the E-I index scores are used, questionnaire data are transformed from being continuous to categorical using the three and four bin options described in option three. Figure 19 shows sociograms for each of the 17 networks with a 100 per cent response rate.

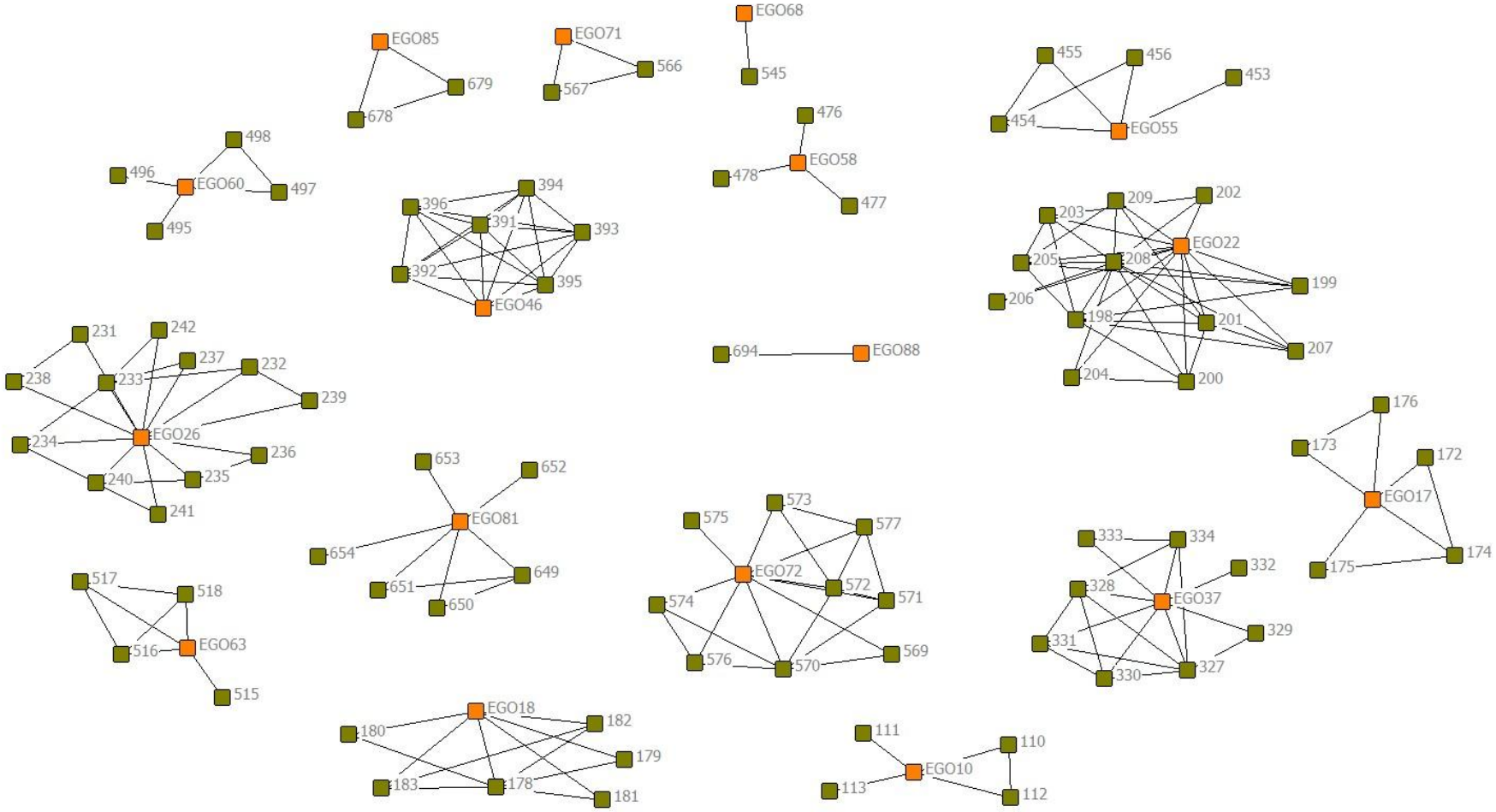

Figure 19: Sociograms of 17 networks with 100 per cent response rate

6.2.3 Using E-I index scores to assess attitudinal similarity

For each of the 17 networks with a 100 per cent response rate, an E-I index score is calculated to assess how similar ego is to their alters. To re-iterate; a tie between two individuals is counted as internal if the individuals have the same characteristic, and external if they do not. In this analysis, characteristics are the attitudinal perspectives, assessed according to the seven constructs in the VBN theory. Scores are transformed from being continuous to categorical as described in option three in section 6.2.2, using four bins for the values constructs and three bins for the remaining constructs. E-I index scores for each of the 17 networks and for each of the seven constructs are shown in Table 37 and Figure 20.

Table 37: E-I index scores for each of the seven value-belief-norm constructs, for 17 networks with 100 per cent response rate

EGO ID	E-I Index Score						
	Altruistic Values	Biospheric Values	Egoistic Values	NEP	AC	AR	PN
10	*0.50*	**-1.00**	**-1.00**	*0.50*	*0.50*	*0.50*	0.00
17	**-0.60**	**-1.00**	**-1.00**	*0.20*	**-0.20**	*0.60*	*0.60*
18	**-0.70**	**-1.00**	*0.70*	**-0.70**	**-1.00**	*1.00*	*1.00*
22	0.00	0.00	**-1.00**	*0.30*	*1.00*	**-1.00**	*0.80*
26	**-0.20**	**-0.30**	*0.70*	*0.50*	*1.00*	**-0.70**	*0.70*
37	0.00	0.00	*1.00*	*1.00*	**-1.00**	*0.50*	*0.80*
46	*0.30*	*1.00*	**-0.70**	*0.30*	**-0.30**	*0.70*	*0.70*
55	0.00	**-0.50**	**-1.00**	**-1.00**	**-1.00**	**-1.00**	**-0.50**
58	**-0.30**	*0.30*	**-1.00**	*1.00*	**-0.30**	*1.00*	*0.30*
60	**-0.50**	*0.50*	**-1.00**	**-0.50**	**-0.50**	*0.50*	**-0.50**
63	0.00	**-0.50**	**-0.50**	**-0.50**	0.00	**-0.50**	**-0.50**
68	*1.00*	*1.00*	**-1.00**	*1.00*	*1.00*	*1.00*	*1.00*
71	0.00	**-1.00**	**-1.00**	**-1.00**	**-1.00**	**-1.00**	**-1.00**
72	**-0.60**	**-0.60**	**-0.80**	*0.10*	**-0.30**	*0.10*	*0.80*
81	*0.30*	*0.70*	**-1.00**	*0.30*	**-0.70**	**-0.30**	**-0.30**
85	**-1.00**	**-1.00**	**-1.00**	**-1.00**	**-1.00**	0.00	**-1.00**
88	*1.00*	*1.00*	**-1.00**	**-1.00**	**-1.00**	**-1.00**	**-1.00**
Mean	-0.05	-0.14	-0.62	-0.03	-0.28	0.02	0.11

Homophilous scores are highlighted in **bold**, heterophilous scores are highlighted in *italics.*

For all of the seven constructs, 39 per cent of E-I index scores are **homophilous** (less than zero), 47 per cent are *heterophilous* (more than zero)

and 14 per cent are zero. The average E-I index score across all seven constructs for all 17 networks is -0.14, indicating a slight tendency for homophily, for egos to select similar alters.

The E-I index scores for the egoistic values construct are typically homophilic, with the mean across the 17 networks being -0.62. The E-I index scores for the biospheric and awareness of consequences (AC) constructs are also typically homophilic (-0.14 and -0.28 respectively). For the altruistic values, NEP and ascription of responsibility (AR) constructs, E-I index scores are very close to zero, indicating that ties in networks are equally homophilic and heterophilic. For the personal norms construct, the mean E-I index score is heterophilic (0.11).

Seven of the 17 networks have five or more E-I index scores that are either all homophilic or all heterophilic. Networks 55, 71 and 85 have six homophilic scores, and the seventh score for all three is zero. Networks 63 and 88 have five homophilic scores; network 63 has two zero's, and network 88 has two heterophilic scores. Conversely, network 68 has only one homophilic score, and network 46 has only two homophilic scores. The remaining ten ego networks have a mix of scores that are approximately evenly homophilous and heterophilous, or zero's. Figure 20 shows a stacked column chart. Each of the 17 networks are shown along the x-axis, with stacked E-I index scores on the y-axis. The taller the 'height' of each individual construct stack, the closer the E-I index score is to either +1 or -1. Scores above the x-axis are heterophilous E-Index construct scores, and below the x-axis they are homophilous. For example, in network 10 (the first column in the chart) the red stack indicates that the network has a large and heterophilic score for the biospheric construct. Whereas in network 58, this same stack is much 'shorter' and above the x-axis, indicating a slight tendency for homophily for the network for the biospheric construct.

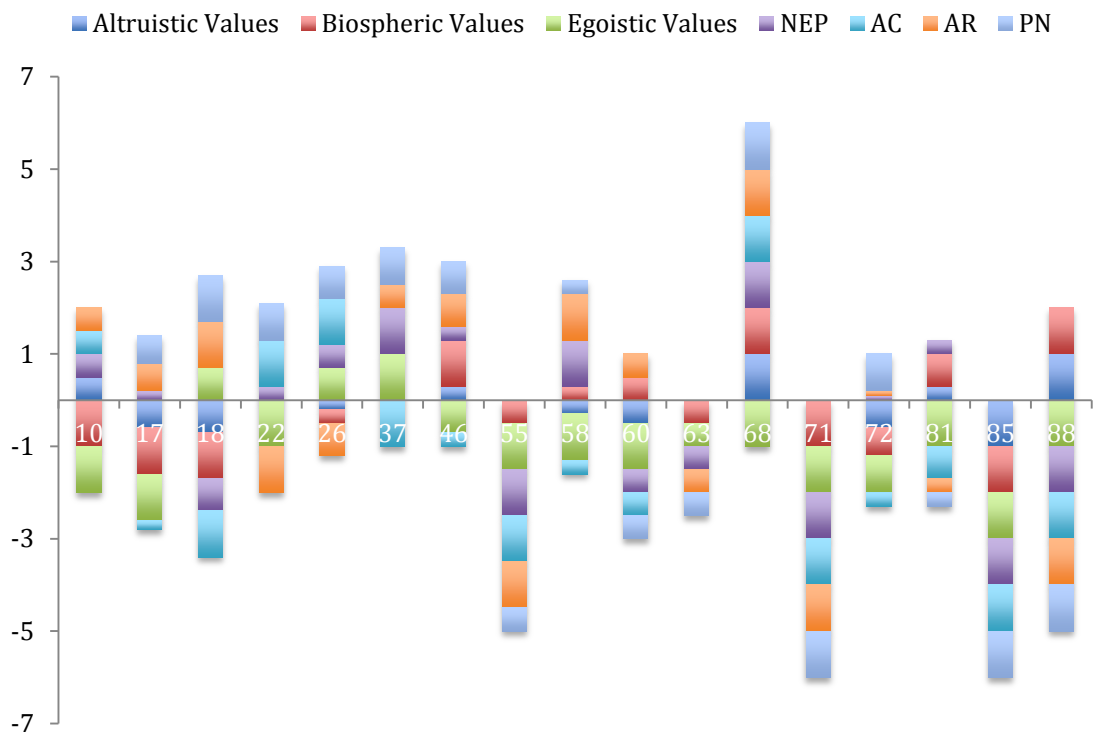

Figure 20: E-I index scores for each of the seven value-belief-norm constructs, for 17 networks with a 100 per cent response rate

In Table 37 and Figure 20 details are given of E-I index scores and networks are highlighted that are particularly homophilic or heterophilic. However, they say nothing about what the actual attitudinal perspectives of ego and their alters are, just that they are similar (or not). The mean construct responses of the egos and alters from seven networks that stand-out from Table 37, are shown in Table 38. Networks that 'stand-out' are selected based upon having five or more E-I index scores that are all homophilic or all heterophilic. Also reported are the mean and standard deviation from the whole data set of 405 responses, along with the figures for one and two standard deviations above and below the mean. Individual construct scores that are particularly unusual, such as those that are either one or two standard deviations above or below the mean, are highlighted in Table 38 with a superscript a,b,c or d. In the top half of the table, are five networks with five or more homophilic E-I index scores (networks 55, 63, 71, 85 and 88). In the bottom half of the table are two networks with five or more heterophilic scores (networks 46 and 68).

Table 38: Value-belief-norm construct mean scores for the five homophilic and two heterophilic networks

Homophilic networks							
	Altruism	Biospherism	Egoism	NEP	AC	AR	PN
EGO55	6.00	5.50	1.80	3.67	5.00[c]	5.00[d]	4.40[c]
453	5.50	5.50	2.40	3.67	3.50	3.75	2.80[b]
454	3.25[b]	6.50[c]	3.80	3.93	5.00[c]	3.75	4.40[c]
455	4.50	4.25	1.20[b]	4.07[c]	4.40	3.75	4.60[c]
456	6.50[c]	6.25[c]	1.80	3.80	4.83[c]	4.00	4.00
EGO63	5.25	5.50	1.60	4.67[d]	4.50	3.75	4.20
515	5.00	6.00	2.00	4.00[c]	4.83[c]	4.50[c]	4.60[c]
516	6.75[c]	6.25[c]	0.00[a]	3.87	3.40	3.50	3.60
517	5.50	6.25[c]	2.20	4.47[d]	5.00[c]	5.00[d]	5.00[d]
518	4.00[b]	3.00[b]	2.20	3.07	3.17[b]	2.75[b]	3.00
EGO71	5.25	0.50[a]	3.20	3.47	4.50	3.50	3.60
566	4.75	4.00	2.00	3.47	4.17	4.00	4.00
567	6.00	4.50	4.20[c]	3.27	3.67	4.00	3.60
EGO85	6.50[c]	5.75	2.80	3.73	4.33	4.25	4.60[c]
678	6.25	6.25[c]	3.60	4.87[d]	4.00	2.00[a]	4.00
679	6.25	5.75	1.60	3.87	4.60[c]	4.00	4.00
EGO88	5.50	5.75	2.00	3.40	3.67	4.50[c]	4.20
694	5.25	4.00	3.20	3.47	4.00	3.50	4.00
Heterophilic networks							
	Altruism	Biospherism	Egoism	NEP	AC	AR	PN
EGO46	6.50[c]	6.25[c]	4.20[c]	3.80	4.33	4.25	4.00
391	5.25	3.25	1.40[b]	3.00[b]	4.00	2.50[b]	3.60
392	3.00[b]	5.00	3.00	3.67	4.33	2.50[b]	2.40[b]
393	5.75	4.50	1.20[b]	3.93	4.00	3.50	3.00
394	3.00[b]	1.00[a]	2.20	2.40[a]	2.83[b]	1.75[a]	1.80[a]
395	3.50[b]	3.50	2.20	2.93[b]	3.17[b]	2.25[b]	2.40[b]
396	6.00	2.50[b]	0.20[a]	2.47[a]	3.83	1.50[a]	2.20[a]
EGO68	5.75	6.25[c]	1.60	3.67	5.00[c]	3.00	2.60[b]
545	3.75[b]	3.00[b]	4.50[c]	2.80[b]	2.40[a]	4.00	2.33[b]
Mean and standard deviation of 405 responses							
Mean	5.26	4.63	2.67	3.5	3.9	3.58	3.63
StDev	1.15	1.41	1.23	0.48	0.62	0.69	0.68
-2StDev[a]	2.96	1.81	0.21	2.54	2.66	2.2	2.27
-1StDev[b]	4.11	3.22	1.44	3.02	3.28	2.89	2.95
+1StDev[c]	6.41	6.04	3.9	3.98	4.52	4.27	4.31
+2StDev[d]	7.56	7.45	5.13	4.46	5.14	4.96	4.99

In Table 38, almost 40 per cent (75 from 189) of the individual construct scores are one standard deviation above or below the mean, with almost 10 per cent two standard deviations above or below the mean. There are 36 scores one standard deviation above the mean (denoted by the letter [c]), of which, there are six scores that are two standard deviations above the mean (denoted by [d]). All of the scores that are two standard deviations above the mean belong to the homophilic networks. Two standard deviations above the mean for the altruistic, biospheric and AC construct is impossible as it is off the scale. There are 39 scores that are one standard deviation below the mean (denoted by [b]), 12 of which are two standard deviations below the mean (denoted by [a]). Nine of the 12 scores that are two standard deviations below the mean belong to the heterophilic networks.

Ego networks 55 and 63 (which are homophilic) have five and six scores that are two standard deviations above the mean, respectively, and 23 of the 36 scores that are one standard deviation above the mean. This suggests that as well as these networks being homophilic, they are also pro-environmental in their attitudinal perspectives. Eighty five per cent of scores for homophilic ego networks 71, 85 and 88 are within one standard deviation of the mean, suggesting that they are quite typical of the whole dataset.

The ego in the heterophilic network 46 has three scores one standard deviation above the mean, whilst the majority of scores for their alters are below the mean, hence heterophily. Fifty per cent of the alters' scores are one standard deviation below the mean, and another 20 per cent are two standard deviations below the mean; none of alters' scores are above the mean. The ego in heterophilic network 68 has two scores that are one standard deviation above the mean, and one that is one standard deviation below the mean, whilst their alter has only one score one standard deviation above the mean and four scores one standard deviation below the mean, and one score that is two standard deviations below the mean. In these two networks, the ego may be considered to be slightly above average with regards to their pro-environmental

perspective, and that they select to be close to colleagues that are below the average with regards to the alters' environmental perspectives.

6.2.4 Relative similarity in attitudinal perspectives of egos and alters

The first test to answer whether ego selected alters who were similar to themselves made the assessment in absolute terms, using the E-I index. The test presented here assesses whether egos selected alters who are similar to themselves, relative to the rest of the alters in the study.

To test whether ego's selected alters who were similar to themselves dependent *t-tests* were used. T-tests calculate whether the means of two sets of data are the same, with the null hypothesis that they are. A t-test returns a value of '*t*' and an associated probability value, '*p'*, the probability of obtaining the value of '*t'* given the sample size. If *p* is less than .05, the null hypothesis that the means of the two sets of data are the same is rejected.

To calculate t-test probability values, three mean scores first need to be calculated. Firstly, ego's mean score is calculated by taking the mean of all of ego's responses to items for a construct. Secondly, a mean is taken of all ego's alters for the same items for the same construct. Thirdly, a mean is taken of all alters from all networks for the same items for the same construct. Using the AC construct (which has six items) and ego network 1 as an example, the mean scores described here are illustrated in Table 39.

Table 39: Example of mean scores calculated for ego, ego's alters and all alters for the AC construct

	N	Construct sum	Construct responses*	Mean
Ego	1	24	6	4
Alters	15	287	67	4.28
All Alters	317	6786	1747	3.88

*not all alters answered every item for the AC construct

Once the three mean scores are calculated, the differences between ego and their alters and egos and all alters can be calculated. To calculate the difference between ego and their own alters, ego's mean score for a construct is

subtracted from the mean score for the construct for their alters – in the example in Table 39, 4.28 - 4 = 0.28. To calculate the difference between ego and all alters, ego's mean score for a construct is subtracted from the mean score for the construct for all alters – in the example above, 3.88 – 4 = -0.12.

If ego selects alters who are more similar to themselves than to all other alters, the difference between ego and their alters will be close to zero, and closer to zero than the difference between ego and all alters. In the example provided here, the difference between ego and all alters is closer to zero than the difference between ego and their own alters i.e. 0.12<0.28.

A t-test does not provide an answer to determine whether a single pair of observations is the same, but does determine whether the means of several pairs of observations are the same. The same mean scores calculated in the example in Table 39, were calculated for 81 of the 88 networks in this study (7 were excluded for having either no alters or no responding alters), for each of the seven constructs. Eighty-one pairs of differences were calculated seven times (a difference between ego and their alters, and a difference between ego and all alters, for all 81 networks, for all seven constructs). A t-test can determine whether the mean score of 81 differences between ego and their own alters is the same as the mean score of 81 differences between ego and all alters.

T-test results in Table 40 show *p-values,* for each of the seven constructs in the VBN theory. To reiterate; the null hypothesis in a t-test is that the mean scores of two samples of data are the same. A *p-value* of less than .05 indicates that the null hypothesis is rejected and that the mean score for each of the two samples is significantly different. In this test, a *p-value* of less than .05 would indicate that either egos are significantly more similar to the alters who they selected than all alters, or that they are significantly more similar to all alters than they are to their own selected alters.

Table 40: *p*-values for *t*-test results for all 81 networks

	Altruistic Values	Biospheric Values	Egoistic Values	NEP	AC	AR	PN
p	.66	.95	.99	.90	.93	.94	.95

Table 40 shows that all *p-values* are greater than .05, indicating that the null hypothesis that the two samples are 'the same' cannot be rejected. This suggets that the difference between ego's mean score for a construct and the mean score of the alters who they select is equal to the difference between ego's mean score and the mean score of all alters included in the study – i.e. egos do not select alters who are more similar to themselves than a randomly selected group of alters. This finding is true for all of the seven constructs in the VBN theory.

Although the t-test results shown in Table 40 indicate that egos do not select alters who are more similar to themselves than randomly selected alters, it may be that certain types of networks, or networks with certain characteristics do have egos who select alters who are similar to themselves, but that this is being hidden in analysing all of the 81 networks together (as in Table 40).

In Chapter 5 networks were separated based upon their size and tie density data. The following t-tests break down the 81 networks into subgroups to identify whether egos in small, medium or large networks, or egos in networks with low medium or high tie density selected alters who are more similar to themselves than the whole sample of alters. The 81 networks are also separated into five of the six clusters that were identified in Chapter 5. The sixth cluster contains networks that have only an ego and no alters, and so has not been included in this analysis. The t-tests are again testing the null hypothesis that the means for the sets of data are the same. The same criteria for rejection of the null hypothesis is being used ($p < .05$). Table 41 shows the results of several t-tests for each of the constructs, separating the 81 networks by cluster, density and size.

Table 41: *p*-values of *t*-tests for attitudinal factors, broken down by cluster, density and size

	N	Altruistic Values	Biospheric Values	Egoistic Values	NEP	AC	AR	PN
Cluster 1	4	.80	.92	.81	1.00	.65	.57	.60
Cluster 2	3	.66	.76	.39	.93	.55	.97	.60
Cluster 3	47	.36	.70	.98	.81	.86	.64	.80
Cluster 4	16	.78	.83	.45	.71	.67	.69	.81
Cluster 5	11	.98	.88	.92	.59	.97	.73	.92
Low Density	12	.78	.82	.52	.88	.71	.57	.82
Medium Density	47	.58	.99	.92	.75	.98	.66	.79
High Density	22	.85	.94	.70	.50	.89	.84	.87
Small Size	27	.99	.70	.82	.74	1.00	.69	.90
Medium Size	45	.33	.62	.83	.98	.97	.64	.80
Large Size	9	.75	.71	.89	.91	.79	.64	.76

Separating the 81 networks by cluster, density or size does not result in any significant differences being found – all values of *p* are above .05. The null hypothesis cannot be rejected for any of the constructs, for any of the subgroups created by separating the 81 networks by their characteristics. This again suggests that egos do not select to be close to colleagues that have attitudinal perspectives that are any more similar to their own than may be expected if they were selected at random.

6.3 Do ego's select alters who accept similar greenhouse gas emission reduction policies to themselves?

In section 6.2, VBN theory data were used alongside social network data to assess whether egos selected alters who had similar attitudinal perspectives to themselves. In this section, the same analyses were carried out, but this time acceptability of the seven policy proposals were used instead of VBN constructs.

Exactly the same tests are carried out here as they were for section 6.2, using the E-I index scores to assess absolute similarity between egos and alters, and t-tests to assess relative similarity.

6.3.1 Using E-I index scores to assess acceptability similarity

The same E-I index calculation that was described and used in sections 6.2.1 to 6.2.3 to assess attitudinal perspective similarity in networks is again used here to assess similarity in acceptability of policy proposals.

Although each individual has only one score for each of the seven policy proposals, and therefore the data could be used as categorical, a recoding of the data is necessary here. The acceptability judgements were asked on a five point Likert scale, from strongly disagree to strongly agree. The data are therefore in five 'bins'. As with the problem identified as option one in section 6.2.2, an individual who agrees with a proposal to reduce DMU's greenhouse gas emissions, scored as a '4' would be treated as being 'external' to an individual who strongly agreed, scored as a '5'. The data are therefore recoded from five bins into three bins, in a similar way as they were in option three in section 6.2.2, for the five-point Likert response scale items. Individuals who either strongly disagreed or disagreed with a proposal were recoded from either a '1' or '2' to a '1'. Individuals who neither agreed, nor disagreed with a proposal were recoded from a '3' to a '2'. Individuals who either agreed or strongly agreed with a proposal, originally coded as a '4' or a '5', were re-coded as a '3'.

An E-I index score is calculated, as before, for each of the 17 networks with a 100 per cent response rate for all seven of the proposals to reduce DMU's greenhouse gas emissions. In the analysis of the VBN data, missing scores were not an issue, as several items were used to make an average score for the construct. For the acceptability judgements, there is only one item that is used to assess acceptability against each proposal, and therefore missing responses are more problematic than they were for the VBN data. Of the 17 egos, all gave their acceptability judgement to all of the seven proposals. For the 89 alters however, a small number are missing. For these, the calculation assessed ego's tie as being external, even though it may not be. As there are a very small percentage of these (there are 89 alters, and seven dependent variable = 623 judgements. 21 are missing = 3.4 per cent) they are left as being

assessed as being heterophilous, external, ties. This has the potential to result in a type II error – a false negative. This is not anticipated, however, given the rest of the results in Table 42. Table 42 shows the E-I index scores for the 17 networks with a 100 per cent response rate for the seven proposals.

Table 42: E-I index scores for 17 networks for seven policy proposals

EGO NETWORK ID	E-I Index score						
	Reduce GHG	Less Funding	Int'l students	Work Home	Parking Permit	Reduce Heating	Train Ticket
10	**-0.50**	0.00	**-0.50**	0.00	*1.00*	**-0.50**	**-0.50**
17	**-0.60**	**-0.20**	*1.00*	*0.60*	*1.00*	*1.00*	**-0.20**
18	**-0.30**	*0.70*	**-0.30**	**-0.70**	**-0.70**	*0.30*	**-0.30**
22	**-1.00**	*0.70*	**-0.20**	**-1.00**	*0.80*	**-0.50**	**-0.30**
26	**-0.80**	**-0.20**	*0.70*	**-0.70**	*0.50*	**-0.20**	**-0.30**
37	**-1.00**	*0.30*	**-0.50**	**-0.50**	**-0.30**	*1.00*	**-0.30**
46	**-0.70**	*0.30*	*1.00*	**-0.30**	*1.00*	**-0.70**	**-0.30**
55	**-1.00**	**-0.50**	*0.50*	**-1.00**	*0.50*	**-0.50**	**-0.50**
58	*0.30*	**-0.30**	**-0.30**	*1.00*	*0.30*	**-0.30**	**-0.30**
60	**-1.00**	0.00	*1.00*	**-0.50**	*1.00*	**-1.00**	**-0.50**
63	**-1.00**	0.00	*0.50*	**-1.00**	0.00	*1.00*	**-0.50**
68	**-1.00**	**-1.00**	**-1.00**	*1.00*	*1.00*	*1.00*	*1.00*
71	**-1.00**	*1.00*	0.00	**-1.00**	0.00	*1.00*	0.00
72	**-0.80**	*0.80*	**-0.60**	**-1.00**	*0.30*	**-0.60**	*0.80*
81	**-0.30**	*0.70*	0.00	**-0.70**	0.00	**-0.70**	*0.70*
85	**-1.00**	**-1.00**	0.00	0.00	*1.00*	*1.00*	*1.00*
88	**-1.00**	*1.00*	**-1.00**	**-1.00**	*1.00*	*1.00*	*1.00*
Mean	-0.75	0.14	0.02	-0.40	0.49	0.14	0.03

Homophilous scores are highlighted in **bold**, heterophilous scores are highlighted in *italics*

In Table 42, 54 per cent of the E-I index scores are **homophilous**, with 36 per cent being *heterophilous*, and 10 per cent being zero. Overall, the mean E-I index score is -0.05, indicating a slight tendency for homophily. The mean E-I index score for the first policy proposal, for DMU to reduce its greenhouse gas emissions, is very homophilous, at -0.75. The fourth policy proposal, to allow working from home also has a homophilous mean E-I index score, at -0.40. The proposal to reduce the number of international students, or for DMU to assist with the cost of annual rail tickets both have scores very close to zero (0.02 and 0.03 respectively). The proposal to increase the price of a car parking permit is heterophilous, with a mean E-I index score of 0.49, with both the proposals for

DMU to receive less funding if it does not reduce its greenhouse gas emissions, and for the target heating temperature to be reduced having mean E-I index scores of 0.14.

There are five networks (networks 18, 22, 26, 37 and 55) that have five homophilous E-I index scores, and two heterophilous scores. There are no networks with more than four heterophilous E-I index scores. The remainder of the 17 networks have a mix of heterophilous and homophilous ties, and zero's. Figure 21 shows a stacked column chart for the E-I index scores of the 17 networks, for each of the seven acceptability judgements.

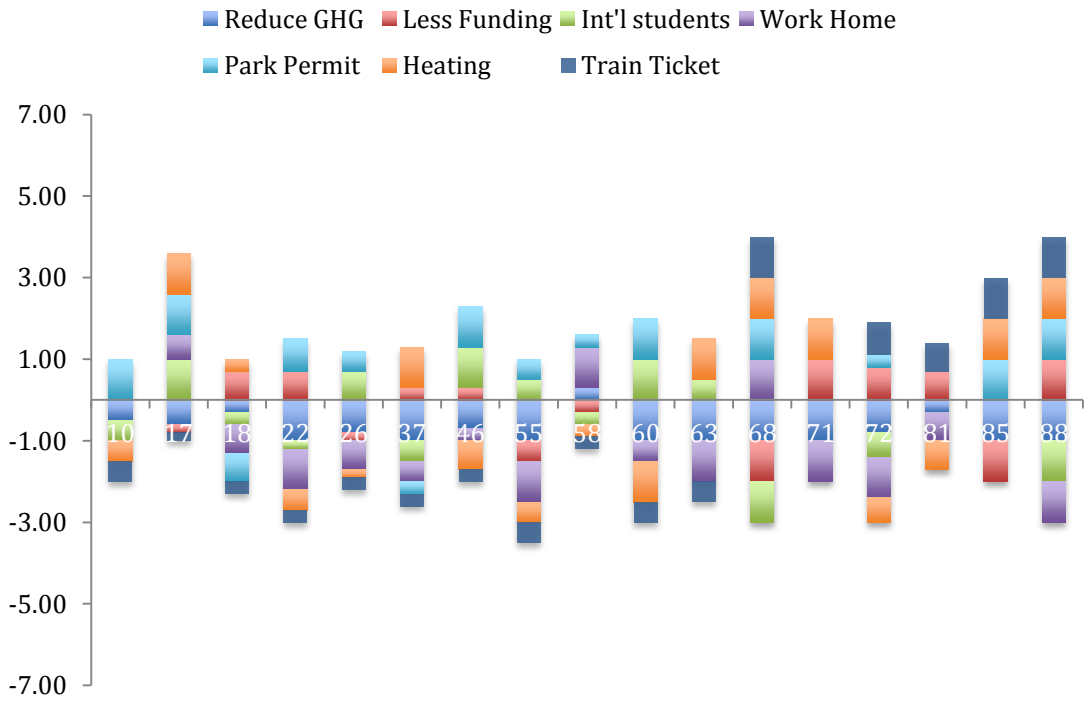

Figure 21: E-I index scores for each of the seven policy proposals, for 17 networks with a 100 per cent response rate

As with the calculations for the VBN constructs, there is no indication in using the E-I index of whether or not egos and alters accepted or rejected proposals to reduce DMU's greenhouse gas emissions, just that there is similarity. For the five networks that have five homophilous scores, the individuals' acceptability of the seven proposals to reduce DMU's greenhouse gas emissions are shown in Table 43.

Table 43: Acceptability scores for five networks with homophilous E-I index scores

	Reduce GHG	Less Funding	Int'l students	Work at Home	Parking Permit	Reduce Heating	Train Ticket
EGO18	5	1[b]	1[b]	5	1[b]	1[a]	4
178	5	4	2	5	2	5	4
179	5	4	3	5	1[b]	2[b]	5
180	5	4	2	5	2	4	5
181	1[a]		1[b]	5	5[c]	2[b]	3
182	5	5[c]	2	5	5[c]	4	5
183	1[a]	4	1[b]	1[a]	1[b]	1[a]	1[a]
EGO22	5	3	1[b]	5	3	4	5
198	5	4	2	5	5[c]	5	5
199	5	3	2	4	2	4	4
200	5	4	1[b]	4	4	2[b]	4
201	5	5[c]	3	5	2	2[b]	3
202	5	3	3	4	4	4	3
203	5	4	2	5	3	4	4
204	5	4	2	5	2	4	5
205	5	4	1[b]	5	4	5	3
206	5	4	4[c]	5	5[c]	5	5
207	5	5[c]	5[d]	5	5[c]	5	5
208	5	5[c]	1[b]	5	1[b]	5	4
209	5	4		5		5	5
EGO26	5	5[c]	4[c]	4	5[c]	5	5
231	5	4	2	5	5[c]	4	5
232	5	4	3	4	2	4	5
233	5	4	2	4	2	5	5
234	5	4	2	5		4	4
235	5	1[b]	1[b]	3[b]	1[b]	1[a]	3
236	5	4	2	4	2	4	5
237	4	1[b]	4[c]	4	1[b]	1[a]	5
238	5	2	4[c]	4	1[b]	5	3
239	4			4			
240	5	4	2	5	5[c]	2[b]	5
241	1[a]	2	1[b]	5	2	1[a]	5
242	4	3	1[b]	4	2	5	5
EGO37	4	1[b]	1[b]	4	5[c]	1[a]	5
327	4	2	2	4	5[c]	4	4
328	5	4	2	5	4	5	4
329	5	5[c]	1[b]	5	2	5	5
330	4	4	2	1[a]	5[c]	3	4
331	5	2	1[b]	5	4	5	2[b]
332	5	4	2	5	2	5	5
333	5	2	3	3[b]		3	5
334	5	4		5	5[c]	4	5
EGO55	5	5[c]	1[b]	5	4	4	4
453	5	5[c]	3	5	2	2[b]	3
454	5	3	3	4	3	4	4
455	5	4	4[c]	5	5[c]	5	5
456	5	4	2	5	2	4	5
Mean	4.36	3.26	2.15	4.24	2.8	3.93	4.02
-2StDev	2.16	0.64	-0.09	2.16	-0.08	1.39	1.62
-1StDev	3.26	1.95	1.03	3.20	1.36	2.66	2.82
+1StDev	5.46	4.57	3.27	5.28	4.24	5.20	5.22

Of the 318 scores in Table 43 (47 individuals x 7 scores; minus 11 missing), 73 (23 per cent) are more than one standard deviation from the mean, including 13 (4 per cent) that are more than two standard deviations from the mean.

For the proposals to reduce greenhouse gas emissions, work from home, reduce the heating and pay for train tickets, the addition of one standard deviation to the mean is above the top of the scale, and for the proposals for DMU to receive less funding and to increase the price of a car parking permit, two standard deviations is above the top of the scale. A total of 130 responses from the 318 (41 per cent) were a '5' (maximum possible score), 108 (34 per cent) of which are not counted as being one or more standard deviations from the mean because of the proximity of the top of the scale.

In addition, removing two standard deviations from the mean of the proposals for DMU to receive less funding, reduce international students and to increase the price of a car parking permit is off the bottom of the scale.

Despite the problems with the scale, and there being no networks that are heterophilous, there are some interesting networks in the table. For example, nearly a third of the total scores that are one or two standard deviations below the mean, belong to ego network 18, despite it being a small network with less than 15 per cent of the individuals in the table. This suggests a preference within this network to reject the proposals. Network 55, which was highlighted in section 6.2.3 as being homophilous and pro-environmental, is again highlighted here for being homophilous. In this analysis, the network has four of 35 scores that are one standard deviation above the mean and none that are two standard deviations above the mean. On 15 occasions a maximum of '5' was scored. This again suggests that this network contains particularly pro-environmental individuals that accept the policy proposals.

For the first proposal, for DMU to reduce its greenhouse gas emissions, nearly all of the scores for the proposals are close to the mean, explaining the high homophily score for the proposal of -0.75. The lack of variability in scores can again partially explain the homophily score of -0.40.

The proposal to double the price of a car-parking permit divides opinion, with 20 out of 44 (45 per cent) scoring more than one standard deviation above or below the mean.

6.3.2 Relative similarity in acceptability judgements of egos and alters

Using the same method as was used to calculate relative similarity in VBN construct scores, responses to the seven policy proposals can be used to understand whether there is any relative similarity between egos and alters.

For this t-test, mean scores are slightly different than they were for VBN construct data. For each policy proposal, each individual only has one score, where previously for the VBN constructs, each individual had up to 15 item responses from which to take a mean score. A network that contains several alters will have several responses for each policy proposal, by virtue of having several people to take a mean from. However, for egos there will only be one data point for each policy proposal. The null hypothesis remains the same as previously – that there is no significant difference between the means of the two samples. The *p-value* test of significance remains at the < .05 level. Table 44 shows the results for all 81 networks.

Table 44: *p*-values for *t*-tests for policy proposals

	DV1	DV2	DV3	DV4	DV5	DV6	DV7
p	.96	.86	.93	.91	.80	.88	.85

As with the t-tests for determining if egos selected alters with similar attitudinal perspectives, there are no *p-values* < .05, indicating that alters are not selected by egos based upon similar acceptance of policies to reduce DMU's greenhouse gas emissions. As with section 6.2.4, the 81 networks can be separated by which cluster they belong to, their size and their density to see whether treating the 81 networks as a whole is concealing some interesting differences. Table 45 shows the results of several t-tests to understand whether dividing up the 81 networks based upon their characteristics can provide any further insight into the data.

Table 45: *p*-values for *t*-tests for policy proposals, broken down by cluster, density and size

	n	DV1	DV2	DV3	DV4	DV5	DV6	DV7
Cluster 1	4	.92	.86	.76	.91	.50	.71	.71
Cluster 2	3	.83	.72	.96	.99	.93	.90	.99
Cluster 3	47	.85	.73	.64	.92	.88	.66	.91
Cluster 4	16	.99	.97	.60	.86	.64	.70	.66
Cluster 5	11	.52	.88	.81	.76	.95	.64	.82
Low Density	12	.87	.91	.81	.72	.69	.78	.38
Medium Density	47	.94	.84	.72	.98	.83	.77	.99
High Density	22	.95	.89	.58	.66	.59	.53	.56
Small size	27	.82	.70	.53	.89	.83	.72	.85
Medium size	45	.85	.96	.74	.80	.67	.83	.86
Large Size	9	.89	.85	.79	.86	.90	.87	.92

Again, separating the 81 networks by cluster, density and size does not give any *p-values* < .05. The null hypothesis that the mean scores are the same cannot be rejected, across all constructs, regardless of the ways in which the 81 networks are divided. This suggests that egos do not select to be close to colleagues that are anymore similar to themselves in acceptability of policy than randomly selected colleagues.

6.4 In networks that are more closely knit, is there less variability in attitudinal perspectives?

This research question seeks to understand whether in networks with a higher proportion of possible ties present, there is less variability in the attitudinal perspectives than in networks with a lower proportion of ties present. In networks where the proportion of ties present is high, it might be anticipated that the variability in attitudinal perspectives is lower than in networks where the proportion of ties present is low. In a network that is more densely connected, with a high proportion of ties present, network members may have a greater awareness of the attitudinal perspectives of their colleagues, and may alter their own attitudinal perspectives to be similar to others in their network. The tests presented here seek to understand if this is true of this study.

Although the tests to understand whether ego selected alters who were similar to themselves provided no significant results, the density measure utilised here includes alter-to-alter ties as well as ego-to-alter ties. Although ego may not select alters who are similar to themselves, there has been no account of alter-to-alter relationships thus far in the analysis. For this test, analysis is at the level of the entire ego network, rather than from ego's perspective only.

Network density is calculated in the same way as it was in section 5.3.3 – it is a measure of the proportion of the possible ties that are present, on a scale of zero (no ties present) to 1 (all ties present). Variability in attitudinal perspectives is measured using standard deviation. Standard deviation is a measure of how much attitudinal perspectives vary from the mean. A single standard deviation score is calculated per network, per construct, using the responses to the questionnaire from every network member. For example, in a network with 10 respondents, for the NEP construct with 15 items, one measure of standard deviation will be calculated of all the 150 responses.

The relationship between network density and variability is assessed using Pearson's *r,* a type of bivariate linear correlation between two variables (Field, 2009). The value of *r* varies between -1 and +1. A score of -1 indicates a perfect negative correlation, i.e. as the value of one variable increases, the other decreases by the same amount. A score of +1 indicates perfect positive correlation, i.e. as the value of one variable increases, the other increases by the same amount. A score of zero indicates that there is no relationship between the variables.

As there is a hypothesis that governs the direction of the relationship between the variables - as density increases, variability decreases - a one-tailed correlation coefficient is calculated (Field, 2009). An associated *p-value*, the probability of getting *r*, given the sample size if the null hypothesis is true, is also calculated. Table 46 shows the values of *r* and *p* for the correlations between network density and standard deviation of VBN constructs.

Table 46: Correlation coefficients for network density and variability

	Altruistic Values	Biospheric Values	Egoistic Values	NEP	AC	AR	PN
r	.05	-.14	-.04	-.13	.03	-.06	.07
p	.32	.09	.36	.11	.40	.28	.24

Table 46 gives the values of *r*, and its probability *p* given the sample size. For each of the seven constructs in the VBN theory, the value of *r* never deviates far from zero, and the probability, *p,* of obtaining such a value for *r* is never $< .05$. The null hypothesis that there is no relationship between network density and variability in attitudinal perspectives cannot be rejected. This suggests that there is a poor relationship between attitudinal variability and density of network ties, i.e. that increasing the proportion of ties present in a network does not reduce the variability of attitudinal perspectives within the network.

6.5 Summary of findings against objectives

The findings against two objectives covered by the analysis in this chapter are presented here.

6.5.1 Objective three

The third objective of this study was:

> *To explore the relationship between attitudinal factors and social networks*

This objective brings together the VBN theory data from the first objective, and the social network characterisation data from the second objective. Individual environmental attitudinal factors have never been analysed in the context of social networks previously. Despite this, results from other studies reviewed in Chapter 3 suggested that individuals connected in networks would have similar attitudinal perspectives. The hypothesis for the objective reflected this:

> *Attitudinal factors towards the environment will be similar amongst those who are connected in networks*

Two sets of analyses were conducted to make assessments against this objective - analysis of similarity was made in absolute terms, and in relative terms. Absolute analysis of similarity was restricted to the 17 networks where 100 per cent of the members of the network had completed and returned the questionnaire. Across the 17 networks for the seven VBN constructs, the average similarity 'score', on a scale of -1 to +1 (where -1 indicates that all network members share the same attitudinal perspectives and where +1 indicates that all network members have different attitudinal perspectives), was -0.14. This score, being less than zero, indicates that participants tend to share similar attitudinal perspectives with their colleagues. This is termed as 'homophily'. Across the 17 networks, 47 per cent of the similarity scores were above zero (indicating 'heterophily'), with 39 per cent being below zero (indicating 'homophily') and 14 per cent were exactly zero. This spread of scores indicates an approximately balanced mixture of similarity and dissimilarity, of homophily and heterophily, in the 17 networks.

A number of networks from the 17 were highlighted whereby, across many of the seven VBN constructs, the participant had selected fellow colleagues with all similar, or all dissimilar, attitudinal perspectives to themselves. In two networks where scores were homophilic – the participant and their colleagues shared similar attitudinal perspectives - the VBN construct scores tended to be *above* the mean of all of the 405 responses. This finding suggests that networks of employees exist that have both *similar* and particularly *pro-environmental* values, beliefs and norms.

From the seven VBN constructs both the egoistic values and the awareness of consequences (AC) construct had particularly homophilic similarity scores. This finding could be due to participants selecting colleagues who are similar to themselves on these constructs, or it could be related to the means and standard deviations of the constructs, and the method chosen for assessment of similarity. 'Bins' were used to group questionnaire responses, to enable a more appropriate assessment of similarity. The egoistic construct had a very low mean score that is almost in the centre of one of the 'bins' used to assess

similarity. Adding or subtracting two standard deviations to the mean score results in participants still being assigned to the same ‘bin’. This suggests that, rather than it being that participants select only those colleagues who are similar to themselves, it is actually that across the sample, a high proportion of colleagues are in the same ‘bin’, regardless of network affiliation. It is improbable to be connected to a colleague with differing attitudinal perspectives, as they are rare. For the AC construct, this effect was not as pronounced as it was for the egoistic values but the mean score was higher than it was for all of the constructs that used a five-point scale; addition or subtraction of one standard deviation from the mean only just straddled another ‘bin’.

The second analysis was made in relative terms and involved assessing the difference in construct mean scores between the participant and their colleagues, and the participant and all others in the study to see which was least. If the participant selected colleagues who had similar attitudinal perspectives to themself, then the difference between the mean attitudinal perspective scores for the participant and their colleagues will be small. If the participants selected colleagues that are more similar to themselves than can be expected from the rest of the sample, then the difference in mean scores between the participants and their colleagues will be less than the difference between the participants and all others in the sample. If the similarity within a network is so pronounced compared to the dissimilarity across all networks, it might be possible to correctly assign a randomly drawn individual to the network from which they belong. All of the networks with participants and colleagues were included in this analysis.

T-tests suggested that the difference between the participant and their colleagues was not statistically significantly different to the difference between the participant and all other employees in the sample. Participants and the colleagues who they selected were no more similar than a randomly drawn pair of individuals. When the analysis was repeated, grouping the networks according to which cluster they belonged to, according to their size, or

according to the proportion of connections present, statistically significant results were not found.

The analysis provided in Chapter 6 suggested a rejection of the hypothesis that attitudinal factors in networks will be similar. In the absolute analysis, networks were found whereby participants selected colleagues who have similar attitudinal perspectives to themselves. However, for every network where this was the case, there were three networks where this was not the case. The relative analysis suggested that the alters selected by the participant had attitudinal perspectives no more similar to themselves than randomly selected employees. Therefore, on the whole, attitudinal perspectives across and within networks were mixed; occasionally a network with similar attitudinal perspectives was found, but this was the exception rather than the rule.

6.5.2 Objective four

The fourth objective in this study was similar to the third, the difference being that it was to analyse similarities in acceptability judgements of policy proposals, rather than attitudinal factors. The fourth objective was:

> *To explore the relationship between acceptability of policies and social networks*

The hypothesis reflected the findings from literature reviewed in Chapter 3. The hypothesis was:

> *Individuals who are connected in networks will have similar acceptability of policies to reduce greenhouse gas emissions*

The analysis carried out for objective four was the same as for objective three. For the absolute test, the mean similarity score was -0.05, indicating a very slight tendency for homophily. Across the 17 networks, 54 per cent of scores were below zero (homophilous), 36 per cent were above zero (heterophilous) and 10 per cent were zero. Again, there is an approximately even spread of scores indicating a balance of similarity and dissimilarity.

A small number of networks were found whereby, across many of the seven policy proposals, the participant had selected colleagues who had similar acceptability judgements to them – i.e. similarity scores were homophilous. No networks were found whereby all or many of the similarity scores were heterophilous. It was difficult to assess whether homophilous networks were significantly in favour (or otherwise) of the proposals due to the proximity of the mean scores for each policy proposal to the top limit of the scale - for four of the seven proposals it was impossible for network members to have a mean score one standard deviation above the mean, at this point was off of the scale.

Three of the policy proposals had similarity scores of interest; the policy proposal for DMU to reduce its greenhouse gas emissions was homophilous, as was the proposal to work from home, whereas the proposal to increase the price of a car-parking permit was heterophilous. As with the discussion for objective three, these findings could be because of selection similarity; or because of a combination of mean score, standard deviation and 'bin' allocations. The proposals for DMU to reduce its greenhouse gas emissions and to allow working from home had the highest mean scores and also the lowest standard deviations, possibly indicating similarity across the whole sample, rather than within networks. Doubling the price of a car-parking permit, the proposal that was found to be heterophilous, had a mean score that was very close to the mid-point of the response scale and was coupled with the highest standard deviation; this scenario is therefore quite likely to deliver heterophilous results. This suggests that the proposal divided opinion across the sample, not just within networks.

A relative test of similarity was also made, following the same method as for objective three. Again, t-tests were used to assess similarity between participants and their selected colleagues, relative to the similarity between the participant and all others in the sample. As with the findings from objective three, no significant t-test results were found, suggesting that the colleagues selected by the participant were no more similar to themselves than randomly

selected colleagues. Again, this was the case when the networks were broken down by cluster membership, size and density characteristics.

The analysis provided here suggested a rejection of the hypothesis that acceptability judgements will be similar within networks. The absolute analysis identified networks that had many homophilous scores, but for every network where this was the case, there were at least two networks where this wasn't the case. In the relative analysis, no results were found that were statistically significant, indicating that participants' colleagues had acceptability judgements no more similar to their own than an employee selected randomly from the organisation.

6.6 Chapter summary

This chapter has been separated into three sections, representing the three research questions that were identified in order to meet two of the objectives of this study. A number of statistical techniques have been used throughout this chapter to provide a quantitative perspective on each of these research questions. These analysis techniques were both exploratory and novel in their approaches to assessing the data gathered with the questionnaire and the social networks tasks. To the knowledge of the researcher, and the literature presented in chapters two and three, this type of analysis has not been carried out previously.

For the first of the three research questions, the absolute and relative similarity of the attitudinal perspectives of individuals selected by egos was assessed. In the absolute analysis, a small number of networks were found whereby ego, and the alter's whom they selected, shared similar attitudinal perspectives across the seven VBN constructs. Further analysis revealed that in two of these networks, VBN scores are consistently higher than might be expected, given the mean and standard deviations for the constructs. These two networks can be considered to be both homophilic in their similarity, and pro-environmental in their perspective; however, they networks represented the exception rather than

the rule. In the other 15 networks analysed in this way, the degree of homophily was much lower, as were the prevailing attitudinal perspectives.

A test of the relative similarity of VBN construct scores in networks revealed that the alters that egos had selected were no more similar to themselves than a randomly selected alter. This was found to be the case for each of the seven constructs when all 81 networks were analysed together and when they were grouped according to the cluster that they belonged to, the size of the network or the proportion of ties present.

In the second of the research questions, the same analysis was carried out, assessing the absolute and relative similarity in policy acceptability. In the absolute analysis, a small number of homophilic networks were found. One of these was highlighted as part of the absolute analysis for the first research question, as being both homophilic and having a pro-environmental perspective. In this analysis, the network was again found to be homophilic and to have higher than average policy acceptability scores. However, again this network was the exception rather than the rule. Another network was found to be homophilic, but had particularly low policy acceptability scores.

In the test of relative similarity, again egos were found to select alters that were no more similar to themselves than randomly selected alters. When this analysis was repeated, with the 81 networks grouped based upon their characteristics such as cluster membership, size and tie density, egos were found in every test to select alters that were no more similar to themselves than randomly selected alters. The final research question sought to understand whether in networks where the proportion of ties present was high, if the variability in attitudinal perspectives within the network would be lower than in networks where the proportion of ties was low. A test of the correlation between standard deviation of attitudinal perspectives and network tie density revealed a weak relationship, which was found to not be statistically significant.

Chapter 7 Discussion and conclusions

The findings presented in this thesis suggested that attitudinal factors and social network influences are not important indicators of acceptability judgements towards policy proposals put forward for reducing greenhouse gas emissions in higher education institutions. The relationships between attitudinal factors and acceptability of greenhouse gas emissions reductions policy were weak, and the attitudinal perspectives and acceptability judgements of individuals in networks were, on the whole, dissimilar. Despite the lack of theoretical explanation for the acceptability judgements, policy characteristics gave an indication of their acceptability. Support was found for the causal chain nature of the relationships between constructs in the infrequently used full VBN theory.

The objective of this chapter is to discuss the findings presented in Chapter 5 and Chapter 6 with reference to the literature presented in Chapter 2 and Chapter 3. This chapter begins with a restatement of the rationale for this study (section 7.1). The implications of the study for practitioners, policymakers and for future research are then discussed (section 7.2). The chapter closes with the recognition of this study's limitations (section 7.3), suggestions for future research (section 7.4) and concluding remarks (section 7.5).

7.1 Rationale for the research

The research presented in this thesis was conducted to address greenhouse gas emissions associated with higher education institutions in the UK. Although higher education institutions account for only a small fraction of the total UK greenhouse gas emissions, they have a unique role to play in efforts to reduce them as educators of the leaders of tomorrow. In the management of greenhouse gas emissions resulting from their own estate, higher education institutions can set an example of best practice to those that it educates.

This thesis focussed on employee acceptability of policies designed to reduce a higher education institution's greenhouse gas emissions. To explain

acceptability, a behavioural theory – the value-belief-norm theory (VBN) – was used. The VBN theory taps attitudinal factors, taking a moral perspective on the explanation of behaviour. It also however, seeks only to explain individual level factors and does not account for the potential influence of social context and social influences to shape attitudinal perspectives and behaviours. The VBN theory was used alongside social network analysis to allow individual attitudinal factors and environmentally significant behaviours to be viewed within the social workplace context.

7.1.1 Contributions to theory

In addition to the rationale for the research with respects to higher education greenhouse gas emissions reductions, the approach in this study has provided a novel contribution to theory. The full VBN theory is rarely exercised –this is the first known usage of the full VBN in the workplace, and only the second known usage of the full VBN to understand policy acceptability. The use of social network analysis alongside environmental attitudinal factors is novel, as is the methodology that allowed alters (colleagues) to self-report their characteristics, rather than collecting proxy reports from egos (participants).

7.2 Implications

In this section, the implications of the findings are discussed in three sections. Firstly, the implications of the findings are discussed with reference to practitioners – those tasked with managing and reducing a large organisation's greenhouse gas emissions. The findings are deemed relevant to practitioners as they seek to find solutions to reduce their institutions greenhouse gas emissions.

Secondly, the findings are discussed with reference to national policy and policymakers. Thirdly, the implications of the results are considered with reference to future research. Researchers in the areas of environmental psychology, behaviour change and social networks will be interested in the findings presented here and they should inform future studies.

7.2.1 Implications for practitioners

Objectives two, three and four have implications for practitioners and are considered here. Objective two is discussed as a stand-alone objective (7.2.1.1), whereas objectives three and four are discussed together (7.2.1.2).

7.2.1.1 Characterisation of staff networks

Higher education institutions seeking to reduce their greenhouse gas emissions by utilising the staff resource of the organisation will be interested to better understand the characteristics of staff networks. Using employees as 'on the ground' conduits through which to channel information is a recognisable feature in many higher education institutions. Some universities, including the study site, use 'environmental champions' to deliver messages to their departmental colleagues, rather than relying upon centralised officers delivering messages in a 'top down' manner. The environmental champions also act as conduits in the opposite direction, taking information obtained from 'on the ground', back to centralised officers.

Part of the reason for the use of environmental champions is their interpersonal influence – employees receive messages from somebody with whom they are more familiar and who is easier to access than the centralised officers. 'Interpersonal influence' is employed to increase the probability that messages are accepted rather than ignored. Understanding the characteristics of the networks of employees will assist higher education institutions in understanding *how far* their messages are being delivered to, and from *how far* they are coming in. Understanding about how far interpersonal influence can spread can assist with the determination of how many champions are required and where they should be located.

For example, in 2013, the study site had a total of 20 environmental champions – one from each faculty, and approximately one from each department/building. Whilst this may seem like a sensible approach, the number of employees for whom each champion is responsible for covering – the *how far* - was very

different; the Faculty of Technology had many more staff members than the Corporate Affairs department for example, but both had only one environmental champion. If everything else is equal, it can reasonably be expected that the task of the environmental champion in the Corporate Affairs department was more likely to be achieved and with less effort than the environmental champion from the Faculty of Technology. Many of the employees in the Faculty of Technology may not be aware of who the Environmental Champion is, and may have never met them. The findings against this objective could be used to justify increasing the number of environmental champions to a specific ratio (1 per 25 staff, for example), or to change the structure of the environmental champions teams so that those responsible for larger Faculties or Departments have assistants, and that these assistants are recruited strategically, again with a specific ratio in mind.

7.2.1.2 Network dissimilarity

Practitioners will be interested in the findings from objectives three and four which suggest that employees do not select to be ‘very close’ with other employees who reflect their own environmental perspectives, or policy acceptability. Although the ‘best’ outcome for practitioners would have been that all participants, regardless of network affiliation, held pro-environmental attitudinal perspectives and policy acceptability, the finding that attitudinal perspectives in social networks are not well defined provides an interesting opportunity for practitioners.

Research by Levitan and Visser (2008, 2009), reviewed in Chapter 3 suggested that changing behaviours was more likely when strong social norms were not present, by delivering a strong and persuasive message. Levitan and Visser (2008, 2009) suggest that diversity in social norms leads to individuals constantly making re-evaluations of their own perspectives, resulting in undefined and unstable social norms. Delivery of a strong and persuasive message is unlikely to be met with discordance, as social norms do not dictate a pre-existing group perspective within which an individual’s position towards an

issue must be seated. The challenge for practitioners is to act upon this uncertainty, to deliver a strong and persuasive sustainability message, and to shape the social norms and attitudinal perspectives where currently they are absent.

Exploring an alternative scenario provides an interesting analogy – where social norms are well defined and explicit amongst a group, changing behaviour may, conversely, be difficult. For example, it may be quite difficult to communicate the value of cycling to a group of sports car enthusiasts, or alternatively, the selling of a high performance sports car to a group of environmentalists. Changing attitudinal perspectives and behaviours with the delivery of a strong and persuasive message to either of these groups may be difficult.

7.2.2 Implications for policymakers

This study has implications for organisations and policymakers that are immediately involved with higher education institutions and environmental issues, such as HEFCE, the Environmental Association of Universities and Colleges (EAUC), National Union of Students (NUS), Universities UK (UUK) and the People and Planet student action group. Beyond higher education institutions and the associated national organisations, the findings are also relevant for policy makers from government departments, such as the Department for Business Innovation and Skills (DBIS) and the Department for Environment Food and Rural Affairs (Defra).

Each organisation should firstly find interest in the acceptability judgements towards the proposals to reduce greenhouse gas emissions. There was support amongst employees for reducing greenhouse gas emissions and for some of the proposals to achieve reductions, such as working from home, reducing heating temperatures and assistance with train ticket costs. Measures pushing change by making environmentally damaging behaviour expensive, such as increasing the price of a parking permit and reducing international students, were found to be less acceptable. Future policy interventions aimed at

organisational greenhouse gas emissions should take into account the type of policy proposals and associated acceptability reported in this thesis.

Beyond the acceptability judgements, the findings from objectives three and four suggesting that staff networks contain diversity in environmental perspectives has implications for national policy. Work on behalf of Defra (Fell *et al.*, 2009) suggested that in order to improve the diffusion of environmental behaviours, 'mavens' should be recruited in order to influence others and to spread messages. Although the study reported here is quite different to the 'mavens' work for Defra, it is complementary; it provides a greater understanding of social network characteristics, and the attitudinal perspectives and behaviours within networks within institutions. Future studies carried out for Defra on the use of 'mavens' should incorporate into their methods, the findings from this study on attitudinal perspectives and behaviour diversity in social networks.

7.2.3 Implications for future research

Due to the exploratory nature and unexpected findings of the research presented in this thesis, there are a number of implications for future research. The implications of each objective for future research are discussed here. Objectives three and four are discussed together, objectives one, two and five are discussed individually.

7.2.3.1 Objective one

For objective one, the findings did not support the hypothesis. There are three reasons that are proposed to explain why such a result could be found in this study, which future studies should seek to clarify:

a) the VBN constructs, as operationalized in this study, do not represent the most appropriate attitudinal factors relevant for policy acceptability
b) the alignment of the personal norms construct with the proposed policies
c) other causal variables, such as those suggested by Stern (2000), were not captured and built into the model

The reasons offered here are prompted by the successes realised in other studies that have used other attitudinal factors, such as those described in 2.2, and they are also based upon the recommendations in the development of a coherent theory of environmentally significant behaviour (Stern, 2000).

a) Relevant attitudinal factors

In many of the studies described in Chapter 2 sections 2.2.2 and 2.2.3, constructs not included in the VBN theory were used to understand acceptability of policy, whereas this study used only constructs from the VBN theory. It is suggested here that a more open and innovative approach to the inclusion of additional or alternative constructs in this study may have led to additional explanatory power in the regression analysis. The strict use of the full VBN theory in this study was to build consistency by adding to the small number of studies in the area of policy acceptability that have used it. This seemed a reasonable approach, given the successes of previous research described in section 2.2.1. Future studies could look to the additional attitudinal factors utilised in the research covered in Chapter 2 sections 2.2.2 and 2.2.3, and seek to develop a more comprehensive model, that is based upon the VBN theory, but with additional or alternative attitudinal constructs. Constructs such as perceptions of policy *effectiveness* or *fairness* were frequently used in the studies covered in Chapter 2 sections 2.2.2 and 2.2.3, and may prove to be successful additions to the VBN theory when used to understand policy acceptability, for example.

Casting the net further afield for attitudinal factors relevant to policy acceptability, it may have been more appropriate to use an altogether alternative theory of behaviour. Jackson (2005) provides a comprehensive guide to the many alternative theories of environmentally significant behaviour. It is possible, given the coercive nature of the policies proposed in this study that taking a ‘rational approach’ to the understanding of behaviour – perhaps using the Theory of Planned Behaviour (Ajzen, 1991), would have been more appropriate than the moral-based VBN theory that was used. Steg *et al.*

(2005:423) do not suggest the use of an alternative theory, but do suggest that the success of the PN construct and the VBN theory will depend upon the characteristics of the behaviour "the variance explained by personal norms, and more generally, VBN theory, seems to differ for different behaviour domains. This may well be dependent on how costly (in terms of money, effort and time) pro-environmental behaviour is". It remains to be seen whether any alternative theories would have provided a better account of policy acceptability, as previous studies utilising alternatives were not identified for inclusion in the literature review. Future studies should seek to understand 'rational-based' theoretical approaches to understanding policy acceptability. Future research that takes a 'moral' approach to understanding policy acceptability should seek to further the understanding of the relevance of additional constructs that are currently not included in the VBN theory.

b) Alignment of the PN construct

It is recognised in Steg *et al.* (2005:417) that adjusting the PN construct (as well as the AC and AR constructs) to closely match the behaviour that is the focus of the study is important - "the predictive power of VBN theory may be enhanced if AC and AR beliefs as well as PN are tuned toward the specific behaviour to be explained". This is especially important for the PN construct - in Steg *et al.* (2005), the PN construct alone explained 29 per cent of the variance in acceptability judgments, increasing only to 32 per cent once the rest of the VBN theory constructs were included in the explanatory model.

In this study, the six items that were used to measure the PN construct (reduced to five after data reduction analysis) were developed to understand personal and moral obligations for 'reducing greenhouse gas emissions'. The PN items were developed in this way as it was felt that the common ground of the seven policy proposals was that each was aiming to reduce the greenhouse gas emissions of the study site. Despite the policy proposals' common ground in the language used, the components analysis presented in Chapter 5 suggested uncommon ground in responses, so much so that the seven policy

proposals were treated separately, and not as a single construct or fewer components.

Given this uncommon ground, the development of a greater number of PN items, perhaps developing specific items for each of the policy proposals might have increased the explanatory power of the VBN theory, and strengthened the relationship between PN and policy acceptability. For example, the policy proposal regarding the price of a car-parking permit, for which PN explained 6.2 per cent of the variance, may have been better predicted by PN items that tapped personal and moral obligations to reduce car use, to use alternative forms of transport or to share car journeys.

Alternatively, the seven policy proposals could have been developed to be similar enough to be treated as a single behavioural construct (as was the case in Steg *et al.*, 2005). This would allow for the development of a PN construct that is tailored and well aligned to the behaviour of interest in a study. Future research should seek to further develop the PN and behaviour relationship, either with the use of several sub-sets of PN items and varied policy proposals, or with a narrower behavioural focus and a well-attuned PN construct.

c) Other causal variables

Stern (2000) has suggested that there are four types of causal variables that affect an individual's propensity to engage in environmentally significant behaviour. In this study, only one of the four types of causal variables, attitudinal factors, was measured. The decision to only measure attitudinal factors was made on the basis of the lack of consistency in the literature reviewed in section 2.3 for the successful selection and use of alternative causal variables affecting policy acceptability.

It is suggested here that the measurement of contextual factors, of personal capabilities, and of habits might have improved the explanation of policy acceptability. For example, the decision to accept or reject the proposal to double the price of a car parking permit may have been more closely related to

the contextual and personal capability factors such as the participants' current usage of the car park, their ability to get to work by means other than a car or their ability to pay an increased parking charge, than attitudinal factors. Equally, this scenario can be applied to the other six policy proposals – acceptance or rejection of the proposal to reduce the heating set point by 1°celsius, could have been more closely related to the participants' experience of the temperature in their office throughout the year, or their desire to dress in certain ways not governed by keeping warm; the decision to accept or reject the proposal to reduce international student recruitment could have been governed by the participants' job role within the university or their own student experiences, background and nationality. Future research should include, where appropriate, other causal variables, such as personal capabilities, habits and contextual variables in their considerations of factors affecting policy acceptability.

7.2.3.2 Objective two

The findings against this objective have implications for future research for those that are primarily focussed on organisations, and also for those focussed on ego networks. Future research using employee social networks in large organisations will be interested in the findings of this objective. This study has provided a robust characterisation of workplace ego networks, which should be used to inform future studies of any type of behaviours and attitudinal perspectives in large organisations. For researchers interested in social networks, the results of this objective add to the understandings of both ego networks and ego networks in organisations. The findings against this objective provide additional understanding of ego networks, and specifically studies that have been carried out in large organisations.

7.2.3.3 Objective three and four

As with objective one, the findings for objectives three and four do not meet the proposed hypotheses and do not fit the expectations drawn from the literature reviewed in Chapter 3. Two reasons are put forward for the findings that cover both objectives and that future research should seek to clarify:

a) ‘False’ network boundary
b) ‘Visibility’ of attitudinal perspectives and behaviours

Each of these is now considered along with suggestions for future research.

a) ‘False’ network boundary

The first reason put forward for the unanticipated findings for objectives three and four is the ‘false’ boundary applied to the elicitation of networks. Participants were asked to name colleagues with whom they felt ‘very close’ – with the rule being that those that they named *must* come from within the organisation. Specifying that those that are named must come from within the organisation within which the participant was employed places a false boundary around the participants’ social network.

The forming of connections within an organisation may be the result of similarities between a pair of colleagues, but may also be because of the requirements of their respective job tasks, seating arrangements resulting in the sharing of an office space or a third colleague that brings the two together. Being ‘very close’ in workplace networks is not therefore necessarily due to attitudinal perspective and behavioural similarity.

In many of the studies covered in Chapter 3, egos were not restricted by boundaries governing ‘where’ those who they named could come from, and these studies showed that attitudinal perspectives and behaviours within networks were similar. It is posited here that the ‘freedom’ to name very close others is more likely to elicit ties to others who share similar attitudinal perspectives and behaviours, and that this ‘freedom’ is one of the reasons for the similarity in attitudinal perspectives and behaviours in the studies covered in Chapter 3. It is possible that the freedom to name ‘very close’ others from outside the organisation in this study might have elicited the names of close friends and family members, and that in these networks, attitudinal perspectives and behaviours might have been found to be similar.

Future research should seek to develop the understanding of the relationships between attitudinal perspectives, behaviours and social networks. These studies should also seek to determine whether the poor relationship found in this study was due to the 'false' organisational boundary that was applied by using the same measures of attitudinal perspectives, behaviours and social networks but removing the organisational restriction.

b) 'Visibility' of attitudinal factors and behaviours

This suggestion is more applicable to the findings from objective four, but also has relevance for the findings from objective three. It is argued that the lack of a social network effect in the similarity of attitudinal factors and policy acceptability may be related to 'visibility'. The attitudinal factors and behaviours of interest in this study are arguably less visible than the attitudinal perspectives and behaviours that were of interest in the studies covered in Chapter 3, such as alcohol, tobacco and drug use. These behaviours are not only more visible but are typically carried out in group situations; it seems plausible that a social network effect is more likely to be found when the behaviour of interest is often carried out in social situations. Attitudinal factors and acceptability of policy proposals is invisible in comparison, and therefore may be less likely to be susceptible to social network effects.

Future research in this area should seek to develop the cumulative understanding of behaviours and social networks, by selecting attitudinal perspectives and behaviours that are more visible than those that were included in this study.

7.2.3.4 Objective five

The findings for objective five have implications for future studies using the full VBN theory. This was found to operate as expected in this study in line with the findings from previous studies utilising the full VBN theory to understand policy acceptability (e.g Steg *et al.*, 2005) and studies of other types of environmentally significant behaviour (Jansson *et al.*, 2011; López-Mosquera

and Sánchez, 2012; and Sahin, 2013). Future studies seeking to understand a coherent set of environmental attitudinal factors - factors that are significantly related to each other in a causal chain - should consider the use of the full VBN theory - it provides a coherent set of environmentally relevant attitudinal factors. The VBN theory would benefit from future studies utilising all of the constructs, unaltered, as originally proposed by Stern *et al.* (1999) and Stern (2000), to build upon the small amount of cumulative understanding that has developed to date.

Stern *et al.* (1999) suggested that the causal chain in the VBN theory may mean that constructs significantly predict other constructs 'further up' the chain that they are not directly connected to. This scenario was found in this study, and echoes the findings of all of the studies that have reported on the relationships between constructs in the full VBN theory (e.g. Steg *et al.*, 2005; Jansson *et al.*, 2011; López-Mosquera and Sánchez, 2012; and Sahin, 2013). Future studies should seek to add to the cumulative understanding of the relationships between the variables in the VBN theory, reporting the results of mediation analysis to assist in the development of this understanding.

7.3 Limitations

The researcher recognises that there are several limitations to the findings presented in this thesis. Firstly, it is recognised that there are ontological and epistemological considerations regarding the nature of what can be known and how it can be discovered, and that these affect the interpretation of the findings presented in this thesis (Gergen, 1998). Furthering this point, it is recognised that the use of a solely quantitative survey methodology designed to tap latent psychological constructs has its limitations (Cresswell, 2013). Analysis of these data with statistical techniques also relies on imperfect methods and arbitrary decisions (Bakan, 1966). These concerns have implications for the interpretation of the findings presented in this thesis.

Limitations remain, even in acceptance of the ontological and epistemological perspective and methodology utilised in this study. The data presented here

were collected only from a sample of self-selecting participants, which raises questions of data bias, generalizability and applicability. Concerns about generalizability and applicability are not limited to extending the findings to the remainder of the population at the study site, but also to other higher education institutions and to other large organisations.

Data collected for this study should also be considered as a temporary cross-sectional snapshot at a particular time, of the attitudinal perspectives and social networks of a higher education institution. Staff social networks are subject to change frequently due to promotions, recruitments, and redundancies, for example. Attitudinal perspectives and behaviours cannot be considered to be reliably stable positions (Breakwell, 2001).

7.4 Future research

Beyond the implications for future research discussed in 7.2.3, there are additional overarching concerns that it should seek to address. Firstly, a replication of this study, at a different site would provide a dataset for comparison and verification of the findings. Secondly, future studies should offer alternative policy proposals to those utilised here. In the study by Steg *et al.* (2005), a set of 16 policy proposals were measured, with various dimensions – coercion type, behaviour type, revenue use and emissions targeted. Future studies of policy acceptability in higher education institutions should seek to develop a similar scale to better inform the role of characteristics of policy on acceptability.

Future research should also seek to address the limitations highlighted in section 7.3 principle among which is the need for qualitative research alongside quantitative; this would provide a deeper understanding of the rationale behind attitudinal and behavioural data. During the data collection exercises, participants frequently made comments about the items included as part of the VBN questionnaire, and also about the policy proposals to reduce greenhouse gas emissions. These verbal comments would have undoubtedly provided fruitful context for the quantitative expressions made in the questionnaire, but

were not captured. Future research should therefore seek to collect qualitative in addition to quantitative data.

7.5 Conclusions

The findings presented in this thesis suggested that attitudinal factors and social network influences are not important indicators of acceptability judgements made about policy proposals put forward for reducing greenhouse gas emissions in higher education institutions. The relationship between attitudinal factors and acceptability of policy was weak, and the attitudinal perspectives and acceptability judgements of individuals in networks were, on the whole, dissimilar. Despite the lack of theoretical explanation for the acceptability judgements, policy characteristics gave an indication of their acceptability and support was found for the causal chain nature of the relationships between constructs in the infrequently used full VBN theory.

A number of reasons were suggested for the unexpected findings presented in this thesis. Future research should look to investigate these concerns. Despite the unexpected findings, implications for practitioners and policymakers arising from this thesis were outlined. The finding that attitudinal perspectives and behaviours in social networks were diverse provides an opportunity for higher education institutions to shape 'environmental' social norms in a place where they are not currently explicitly defined, delivering strong messages for environmental protection.

Whilst shaping such social norms and therefore indirectly shaping attitudinal perspectives might provide an opportunity for higher education institutions, the evidence provided in this thesis suggests a significant gap between attitudinal factors and behaviour that may mean behavioural changes are not realised. In addition, it remains to be seen whether such a strong message can be delivered; not just by the practitioners within universities, but by universities as a whole. The needs for higher education institutions to simultaneously wrestle sustainability issues with pressing economic concerns provide a difficult challenge. Although it may be that opportunities to approach both challenges

can be synchronised (reducing energy consumption reduces costs) there are equally concerning trends in the higher education sector that are environmentally unsustainable, but that provide revenue streams. Recent government policy has suggested that a realistic target to achieve is for an increase of 15-20 per cent in the numbers of international students studying in the UK (DBIS, 2013). The same policy sets out plans to globalise UK higher education – 'transnational education' - allowing students to stay in their home country by bringing education to them (DBIS, 2013). Both place economic concerns above environmental sustainability concerns, and make for delivery of the environmental sustainability message seem hypocritical.

The finding that policy coercion affected acceptability should inform future policy development at higher education institutions. Practitioners should be aware of the sensitivities of employees towards the consequences of policies for themselves and how this affects their acceptability, despite seemingly pro-environmental attitudinal perspectives. Solutions should be sought that minimise disruption, inconvenience and costs to employees, whilst achieving emissions reductions.

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Appendix 1 Ego questionnaire

De Montfort University Sustainability Survey

About this Survey

This survey has two main sections.

- *Section I asks about your values and your beliefs*
- *Section II explores proposals that De Montfort University might adopt to reduce its greenhouse gas emissions.*

There are no right or wrong answers; we are interested in what you think.

Thank you for your assistance in this research.

If you have any questions, please ask the interviewer who will clarify any issues you may have

Section I – Values and Beliefs

Thirteen values are described in the following table. Following each value in brackets is a description of its meaning. Please indicate how important each value is for you ***AS A GUIDING PRINCIPLE IN YOUR LIFE.***

Use the rating scale below:

-1 means the value is opposed to the principles that guide you.
0 means the value is not at all important; it is not relevant as a guiding principle for you.
3 means the value is important.
6 means the value is very important.
7 means the value is of supreme importance as a guiding principle in your life; ***often there are no more than two such values.***

Try to distinguish as much as possible between the values by using ***different numbers***.

Values	Opposed to my values	Not important			Important				Very important	Of supreme importance
Equality (*equal opportunity for all)*	-1	0	1	2	3	4	5	6	7	
Respecting the Earth (*harmony with other species)*	-1	0	1	2	3	4	5	6	7	
Social Power (*control over others, dominance)*	-1	0	1	2	3	4	5	6	7	
Unity with Nature (*fitting into nature)*	-1	0	1	2	3	4	5	6	7	
A World at Peace – (*free of war and conflict)*	-1	0	1	2	3	4	5	6	7	
Wealth – (*material possessions, money)*	-1	0	1	2	3	4	5	6	7	
Authority – (*the right to lead or command)*	-1	0	1	2	3	4	5	6	7	
Social Justice – (*correcting injustice, care for the weak)*	-1	0	1	2	3	4	5	6	7	
Protecting the Environment – (*preserving nature)*	-1	0	1	2	3	4	5	6	7	
Influential – (*having an impact on people and events)*	-1	0	1	2	3	4	5	6	7	
Helpful - (*working for the welfare of others)*	-1	0	1	2	3	4	5	6	7	
Preventing Pollution – (*protection of natural resources)*	-1	0	1	2	3	4	5	6	7	
Ambitious – (*hardworking, aspiring)*	-1	0	1	2	3	4	5	6	7	

Please indicate how much you agree with each of the following statements.

Please tick **only one** box per statement

Belief Statements	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
We are approaching the limit of the number of people the Earth can support	☐	☐	☐	☐	☐
Humans have the right to modify the natural environment to suit their needs	☐	☐	☐	☐	☐
When humans interfere with nature it often produces disastrous consequences	☐	☐	☐	☐	☐
Human ingenuity will ensure that we do not make the Earth unliveable	☐	☐	☐	☐	☐
Humans are severely abusing the environment	☐	☐	☐	☐	☐
The Earth has plenty of natural resources if we just learn how to develop them	☐	☐	☐	☐	☐
Plants and animals have as much right as humans to exist	☐	☐	☐	☐	☐
The balance of nature is strong enough to cope with the impacts of modern industrial nations	☐	☐	☐	☐	☐
Despite our special abilities, humans are still subject to the laws of nature	☐	☐	☐	☐	☐
The so-called “ecological crisis” facing humankind has been greatly exaggerated	☐	☐	☐	☐	☐
The Earth is like a spaceship with very limited room and resources	☐	☐	☐	☐	☐
Humans were meant to rule over the rest of nature	☐	☐	☐	☐	☐
The balance of nature is very delicate and easily upset	☐	☐	☐	☐	☐
Humans will eventually learn enough about how nature works to be able to control it	☐	☐	☐	☐	☐
If things continue on their present course, we will soon experience a major ecological catastrophe	☐	☐	☐	☐	☐

The following section of the survey uses the terms “global climate change” and “greenhouse gases”. Before you continue further, please take a moment to read the following paragraph:

The term “global climate change” is often used to describe worldwide changes in average near-surface air temperatures over long periods of time. It is thought that this is caused by increased concentrations of “greenhouse gases” in the atmosphere. There are six such “greenhouse gases”, the most abundant of which is called carbon dioxide (CO_2). Carbon dioxide is emitted into the atmosphere when fossil fuels such as coal, oil and gas are combusted.

Please indicate how much you agree with each of the following statements.

Important: We are interested in what you think. There are no right or wrong answers.

Please tick **only one** box per statement

Statements	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree	Don't know
Burning fossil fuels does not contribute to global climate change	☐	☐	☐	☐	☐	☐
Environmental quality will improve if we emit less greenhouse gases	☐	☐	☐	☐	☐	☐
Because my personal contribution is very small I do not feel responsible for global climate change	☐	☐	☐	☐	☐	☐
People like me should do everything they can to reduce their greenhouse gas emissions	☐	☐	☐	☐	☐	☐
Global climate change is a problem for society	☐	☐	☐	☐	☐	☐
I do not feel personally responsible for my emissions of greenhouse gases	☐	☐	☐	☐	☐	☐
I feel personally obliged to bear global climate change in mind in my daily behaviour	☐	☐	☐	☐	☐	☐
I would not feel morally obliged to bear fuel efficiency in mind were I to purchase a car	☐	☐	☐	☐	☐	☐
I do feel morally obliged to reduce my greenhouse gas emissions, regardless of what others do	☐	☐	☐	☐	☐	☐
Reducing greenhouse gas emissions helps to reduce the effects of global climate change	☐	☐	☐	☐	☐	☐
It is not certain whether greenhouse gas emissions cause global climate change	☐	☐	☐	☐	☐	☐
I feel personally responsible for my contribution towards the global climate change problem	☐	☐	☐	☐	☐	☐
I feel personally obliged to reduce my greenhouse gas emissions as much as possible	☐	☐	☐	☐	☐	☐
The government and industry are responsible for greenhouse gas emissions, not me	☐	☐	☐	☐	☐	☐
Global climate change causes extreme weather events such as flooding or droughts	☐	☐	☐	☐	☐	☐
I do feel morally obliged to use public transport whenever I can	☐	☐	☐	☐	☐	☐
I feel jointly responsible for worldwide greenhouse gas emissions	☐	☐	☐	☐	☐	☐
Individuals on their own cannot contribute to the reduction of greenhouse gas emissions	☐	☐	☐	☐	☐	☐

Section II - Proposals

a) Central government has set national targets for the reduction of greenhouse gas emissions.

*Please indicate how acceptable the following proposal is (*Please tick **only one** box)*:*

Proposal	Very unacceptable	Somewhat unacceptable	Neither acceptable nor unacceptable	Somewhat acceptable	Very acceptable	Don't know
De Montfort University should reduce its greenhouse gas emissions	□	□	□	□	□	□

b) Central government has proposed changes to the way it gives money to universities, linking the amount of funding to the university's greenhouse gas emissions.

*Please indicate how acceptable the following proposal is (Please tick **only one** box):*

Proposal	Very unacceptable	Somewhat unacceptable	Neither acceptable nor unacceptable	Somewhat acceptable	Very acceptable	Don't know
If De Montfort University does not reduce its greenhouse gas emissions it should receive less funding from central government	□	□	□	□	□	□

The following five statements relate to **hypothetical** proposals that De Montfort University ***could*** adopt. They **do not** necessarily relate to ***actual*** proposals.

1) Around 13% of greenhouse gas emissions associated with a university's activities is from international students travelling between their home country and the university. De Montfort University currently has approximately 1500 attending international students.

*Please indicate how acceptable the following proposal is (Please tick **only one** box):*

Proposal	Very unacceptable	Somewhat unacceptable	Neither acceptable nor unacceptable	Somewhat acceptable	Very acceptable	Don't know
De Montfort University should reduce future enrolments of attending international students by 20%	☐	☐	☐	☐	☐	☐

2) Around 8% of a university's greenhouse gas emissions come from staff commuting to and from the university.

*Please indicate how acceptable the following proposal is (Please tick **only one** box):*

Proposal	Very unacceptable	Somewhat unacceptable	Neither acceptable nor unacceptable	Somewhat acceptable	Very acceptable	Don't know
Where possible, De Montfort University should allow staff the option to work from home one day per week	☐	☐	☐	☐	☐	☐

3) The annual fee for staff to park their car at De Montfort University is £120

*Please indicate how acceptable the following proposal is (Please tick **only one** box):*

Proposal	Very unacceptable	Somewhat unacceptable	Neither acceptable nor unacceptable	Somewhat acceptable	Very acceptable	Don't know
De Montfort University should gradually increase the price of a parking permit so that in five years it is double what it is now (£240)	☐	☐	☐	☐	☐	☐

4) De Montfort University has an energy policy stating that during the winter months, offices, classrooms and lecture halls will be heated to 21°C during working hours.

*Please indicate how acceptable the following proposal is (Please tick **only one** box):*

Proposal	Very unacceptable	Somewhat unacceptable	Neither acceptable nor unacceptable	Somewhat acceptable	Very acceptable	Don't know
De Montfort University should lower the target temperature that offices, classrooms and lecture halls will be heated to during working hours in the winter months to 20°C	☐	☐	☐	☐	☐	☐

5) Some staff travel to De Montfort University by train. Annual train travel tickets cost about 10-20% less than purchasing monthly tickets. However, they must be paid for in advance and can cost several thousands of pounds (an annual ticket from Nottingham costs £1476)

*Please indicate how acceptable the following proposal is (Please tick **only one** box):*

Proposal	Very unacceptable	Somewhat unacceptable	Neither acceptable nor unacceptable	Somewhat acceptable	Very acceptable	Don't know
De Montfort University should pay for annual train travel tickets for staff, and collect the money back through monthly wage contributions, interest free.	☐	☐	☐	☐	☐	☐

A few questions about you…

These final questions help us to understand more about the responses you have given earlier in the survey.
The information provided *will not* be passed onto third parties and will be used only for academic purposes.

Please tell us how old you are:

16-24 25-34 35-44 45-54 55-64 65+

Are you?

Male Female

Which job type best describes your main role at De Montfort University:

Academic Staff – teaching Academic Staff – research Support Staff – administrative Support Staff – teaching Support Staff – other

What is your employment status at De Montfort University?

Full-time Part-time

How many years have you worked at De Montfort University?

Less than 1 year 1-3 years 3-5 years 5-10 years More than 10 years

What is your highest level of educational attainment achieved to date?

GCSE A-Level Undergraduate degree Postgraduate degree Doctoral

What is your income per annum, before tax?

Less than £10,000 £10,001-£20,000 £20,001-£30,000 £30,001-£40,000 £40,001-£50,000 £50,001-£60,000 more than £60,000

Appendix 2 Alter questionnaire introduction

De Montfort University Sustainability Survey

Why have you received this survey?

This survey is part of an initiative by De Montfort University and the University's Sustainable Development Taskforce (SDTF).

This survey has been given specifically to you because you have been selected by a fellow colleague at De Montfort University. If you do not wish to fill it in, or have already filled it in, simply return it in the enclosed envelope blank. Please **do not** ask somebody else to fill it in for you.

The whole survey should take about 10 to 15 minutes to complete in full. When you have completed the survey, please return it in the envelope provided in the internal mail.

About this Survey

This survey has two main sections.

- *Section I asks about your values and your beliefs*
- *Section II explores proposals that De Montfort University might adopt to reduce its greenhouse gas emissions.*

There are no right or wrong answers; we are interested in what you think.

All data collected will be treated with the strictest confidence and anonymity is guaranteed.

Thank you for your assistance in this research.

Appendix 3 Email invitation to ego

Subject: Sustainable Development Taskforce – making contact

Dear [insert name],

I would be grateful for 15-20 minutes of your time to complete a survey about sustainability at DMU.

This survey is part of the work of the Sustainable Development Taskforce which was formed in October 2007 to lead sustainability work at DMU. The Taskforce is committed to engaging with staff and students at DMU, seeking opinions on how DMU can become more sustainable.

The survey contains a set of short statements with multiple choice responses plus a social network exercise. This is best done in person so I would be grateful if we could make an appointment to meet and to complete the survey (which should take no longer than 15-20 minutes). When would be a good time for us to meet?

This survey builds on the information gained by the Taskforce in a survey administered last year. The results of the survey will be used by the Taskforce and as part of a PhD thesis. All data collected will be treated with the strictest confidence and anonymity is guaranteed.

Kind regards,

Carl Holland

Appendix 4 Reminder email to egos

Subject: Fwd: Sustainable Development Taskforce – making contact

Dear [insert name],

Last week, I sent you an invitation to take part in a survey about sustainability at DMU. It is important to gather as many opinions as possible about sustainability at DMU, and so reminder invitations are being sent to those that haven't made contact yet.

The survey takes about 15-20 mins to complete, and is part of the work of the Sustainable Development Taskforce. The survey contains a set of short statements with multiple choice responses plus a social network exercise. This is best done in person so I would be grateful if we could make an appointment to meet and to complete the survey. When would be a good time for us to meet?

The results of the survey will be used by the Taskforce and as part of a PhD thesis. All data collected will be treated with the strictest confidence and anonymity is guaranteed.

Kind regards,

Carl Holland

Appendix 5 Data collection script

Section 1: Introduction

My name is Carl Holland. I am a PhD student at the Institute of Energy and Sustainable Development here at De Montfort University. This survey is part of my PhD thesis.

This survey is a follow on from a survey that the Sustainable Development Taskforce administered in October 2009. The SDTF were set up in the autumn of 2007 to guide sustainability work within DMU.

Section 2: Formalities

All data collected will be treated with the strictest confidence and anonymity is guaranteed.

You are free to leave at any stage without the need for explanation

You can ask questions of the interviewer at any time

Section 2: The Survey

The survey has two sections and then an interactive exercise

There are no right or wrong answers for each question

Most questions are closed questions requiring only a tick in a box.

The survey and interactive exercise should take no longer than 15 – 20 mins to complete

Are there any questions that the interviewee wants to ask before we start?

Appendix 6 Ego networks task instructions

Social Ties at Work

In this section, we have two linked tasks that explore your social ties at work. Please feel free to ask the interviewer for help should you require it.

Task 1: Please name as many work colleagues as you wish, that you are "very close" to. "Very close" work colleagues are those that

- **You discuss important matters with,**
- **You regularly keep in touch with,**
- **Are there for you when you need help.**

These colleagues can come from any department within De Montfort University.

Please write the names of the individuals on the post-it notes that are provided and attach them to the sheet of A3 paper given to you by the interviewer.

Task 2: Once you have listed all the work colleagues that you feel "very close" to, and attached the post-it notes to the A3 sheet, please draw lines on the A3 sheet to indicate colleagues that you feel are "very close" *to each other*. Again, please feel free to ask the interviewer if you require any assistance in this task.

Appendix 7 Reminder email to alters

Subject: Reminder: Sustainability survey

Dear [insert name],

A few weeks ago, I surveyed a colleague of yours about sustainability at DMU.

In the survey, your colleague named you as a social tie at work, and as such they were given a further survey about sustainability to pass on to you. It is very important that we collect as many surveys as possible from friends of friends, and this is why I am contacting you.

The survey takes about 10-15 mins to complete, and is part of the work of DMU's Sustainable Development Taskforce. The survey contains a set of short statements with multiple choice responses. There are no right or wrong answers, we are seeking your views on how DMU should tackle sustainability.

All data collected will be treated with the strictest confidence and anonymity is guaranteed. If you have lost or disposed of your copy of the survey, please contact me for a further copy. Apologies and thanks if you have already completed and returned the survey.

Kind regards,

Carl Holland